DEC 1 1923

November 29, 1923

Engineering News-Record

Devoted to Civil Engineering and Contracting.

McGraw-Hill Company, Inc.

Articles in this issue:

Highways

In "Studies in Highway Traffic and Finance" there are abstracted several committee reports read at the recent annual meeting of the Advisory Board on Highway Research of the National Research Council.

Buildings

Rochester, N. Y., has made an interesting study of three types of schoolhouses, comparable as to capacities and dimensions.

Water-Works

Aeration, followed by sedimentation and filtration, without use of chemicals, is the iron removal system employed in the new 8-m.g.d. plant in Sioux Falls, S. D.

Research

Extensive work which is being done in the fields of cement, brick, hollow tile and stone by the U. S. Bureau of Standards is reviewed.

Railways

Unique in railroad building is the construction of a state line undertaken by North Carolina to give access to the mountainous west by a road over the Blue Ridge.

Reclamation

The sixth article in the series on Federal Land Reclamation is contributed by H. H. Brook, President of the Elephant Butte Irrigation District, New Mexico, and is a discussion of the farmers' side of reclamation troubles.

That slip-shod work in the shadows

How many rejections — how many rough spots in finished products that discredit manufacturers—are the result of carelessness encouraged by uncertain side light or artificial light that compels men to work half the time in heavy shadows.

The finest machine is no better than the man directing it—and the man is no better than his light. Daylight—clear, shadowless top light from all directions flooding the plant through Federal Glass-Insert Tile — is often a greater aid to production than the finest of machinery. It makes men see their work in a new light!

Such a roof combines daylight with the unmatched durability of pre-cast, stone-concrete of *Federal* quality—a quality that has made Federal Cement Tile first choice of the leaders of industry. Federal Glass Insert Tile bring the light directly from above and exactly where it is needed.

Federal Tile is made with and without glass inserts —made in our large daylight shops, laid under the direction of experts, guaranteed by—

FEDERAL CEMENT TILE CO.
110 SO. DEARBORN ST., CHICAGO

The daylight roof

FEDERAL Cement Tile

"The Roof for Permanence"

A Consolidation of Engineering News and Engineering Record — McGraw-Hill Company, Inc.—James H. McGraw, *President*

ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. Mehren, *Editor*
Frank C. Wight, *Managing Editor*

Volume 91 — NEW YORK, NOVEMBER 29, 1923 — Number 22

South Against West

WHERE shall national funds be spent for making unproductive land fit for agriculture? In the West, or in the South, or in both? That was the major theme of the reclamation conference held at New Orleans last week. The West had its innings during the past twenty years, and now the South is ready for its turn, and it calls upon the West to help it get it. There were addresses and thoughtful discussions of the common interests of West and South, it is true, and as our report of the conference (on another page) indicates there was a general spirit of working together. Yet at bottom the situation brought before the public by this movement is one of competing demands—of the West for further federal expenditure in irrigation, of the South for the financing of drainage and land-clearing work along its coasts. The question of paramount public concern of sound national policy in reclamation investment received only minor notice. It seems to be taken for granted that government funds should and must needs be given for land development work. Yet it is this point which the citizen at large demands to have settled first of all. Once a basic policy is established, and a system of administering it with full success is devised, the apportionment of expenditures between geographical sections will be easily accomplished, and no logrolling will be needed for satisfactory adjustment. The permanent Southern Conference can do nothing better than deal with the present reclamation problem and help in solving it; this once solved, and the need for federal reclamation work as well as a sound method for the work determined, the claims of the South will be satisfied without further demand.

Sources of Road Funds

A STIMULATIVE study in highway finance, as reported by the committee on finance of the Advisory Board on Highway Research of the American Research Council, is published in this issue. The road funds of four counties in Wisconsin are traced from source to destination. Incidentally the same sort of investigation is now being made in other states, with indications at present that the evidence will confirm the Wisconsin findings. In brief, these are that the bulk of all expenditures for all roads are county and township funds and that the bulk of all funds for all roads is provided by taxes on property and income. The precise figures are given in the committee report. Leaving the economist and the taxation expert to draw their own lessons from these figures, what conclusions do they suggest in respect to the extent of competent engineering direction of all expenditures for road improvement? We can reason only from inference as the committee report does not touch this subject. The inference is that the bulk of county and local road funds are spent under the sole supervision of county and township highway officials. State and federal expert engineering direction dictates only the lesser part of all highway expenditures. It influences county road expenditure in a varying measure and is altogether remote from township expenditure.

Misinformation on Muscle Shoals

ONE of the great disadvantages of having a silent President—we will not attempt to sum up the advantages—is that it affords such wonderful opportunity for the Washington newspaper men to put thoughts into the executive head. A sample is the recent flood of reports from the capital as to the President's attitude toward Muscle Shoals. These reports, whether they represent Mr. Coolidge's mind or not, are most discouraging for they indicate that Washington newspaperdom, in spite of its exceptional intelligence, does not understand the Muscle Shoals situation or the Ford offer. The gist of the reports is that the President is now contemplating the construction of a steam plant at Florence so that Muscle Shoals may be made sufficiently attractive to make Henry Ford forget his ill temper at the sale of Gorgas to the Alabama Power Co. and renew his offer for Muscle Shoals. This is pure Ford propaganda. Those who have followed the case know that the one or two million dollars involved in a steam plant is a drop in the bucket compared to the perpetual franchise Ford is asking the government to give him in violation of the water power law of the country. To present the government in the rôle of a suppliant to Henry Ford is ridiculous.

Municipal Treason

NEW YORK CITY'S commercial interests are in one of their periodical fits about the diversion of business to other ports. They have found out again, it seems, that while New York still gets almost all the transatlantic business certain other ports are growing faster and they scent a railway plot to build up a southern rival. Thereupon they urge the rearrangement of the port's facilities, not necessarily to reduce the cost of handling freight but to insure an increase in the amount of freight handled. And every New York business man, listening to the dire prospects of a luncheon speaker's prophecies, feels that somehow his personal fortune is dependent on that increase in amount of freight handled. This delusion of size is not confined to our largest city, but it is more ridiculous there than elsewhere. New York is big enough, but by its own metropolitan attraction it will continue to grow. In that growth it will not become a better place to live in or to do business in, nor will many individuals profit more than they already do. What will happen is that more individuals will flock there to take their profits, and by so flocking increase the unit cost of living and of doing business, an increase that is a charge against the whole nation which pays a tax on all the goods that moves through the metropolis. If some of

this new business can be diverted elsewhere, New York and New Yorkers will not suffer—except in self-esteem—and the rest of the country will benefit. No one can set the optimum limit of size in our cities but few will doubt that a number of our biggest cities have passed it. If this be treason let the Chambers of Commerce of our cities make the most of it.

Highway Transport Surveys

THERE is a distinction between a transport survey and a traffic census which needs to be more often remembered in taking account of highway traffic. There are few states which have made transport surveys of any sort and only one state which has carried to anywhere near conclusion a state-wide transport survey. More states, in all about forty, have made some sort of traffic count, most generally of a local character, which may be designated as a traffic census. These statements are drawn from a tabulation of "traffic surveys" by states prepared by G. E. Hamlin, whose report on highway traffic analyses to the Advisory Board on Highway Research of the National Research Council, is published in abstract in this issue. The significant value of this tabulation is the clear indication that beyond general observation highway engineers have no knowledge, except in one or two states, of state-wide traffic conditions. They are proceeding, with road planning virtually without precise knowledge of road use. They are entirely safe in doing this because no matter where or how fast roads are built the traffic is there, or almost immediately develops, to put them into full service. Conditions are arising, however, which put another aspect on the situation. The safe task of deciding that traffic warrants turning an unimproved trail into an improved road or a surfaced road into a paved road is giving way to the hazardous task of telling when three-way or four-way roads, with heavy pavement sections, are economically justified. The traffic counts of the past, either in scope or precision, are not sufficient for the present and are totally inadequate for the near future, and already in many states and localities, need to give way to the transport survey.

Unwise Taxing

THE United States is alone of the great commercial nations in levying an income tax on its nationals who are earning an income in trade or profession in foreign countries where they reside and where the local nation taxes all residents of whatever citizenship. For some years there has been agitation to abrogate this feature of the income tax law but it has been so far successfully opposed probably because there has been fear that any such revision would also relieve from taxation the expatriate who is living on a nonearned income. The law is so serious a drain on our foreign trade, however, that every effort should be made in the coming Congress to write an amendment which would not protect the expatriate capitalist but which would make foreign trading or professional practice less of a burden than it now is. Secretary Hoover in a recent address put the case clearly. In the field of engineering alone the situation is deplorable. "Before the war," said the Secretary, "there were at least 1,000 American engineers employed at substantial salaries in the territories of our former allies. These men went abroad to install American methods, American machinery and equipment in the production of raw materials, and in transportation. These salaried workers now find themselves subject to two gigantic income taxes and thus their foreign mission is unprofitable. I doubt whether there are 100 of them left in foreign territories today. A vast amount of American machinery and equipment that followed in their wake has dried up." So long as the other great producing nations absolve their foreign residing citizens from the rigors of a tax on earned income, there will be increasing difficulty in getting Americans to compete in a field where they have to pay a double tax.

A Demonstrated Danger

A DISTINCTLY new situation is created by the fact that on two separate occasions within the past couple of years secondary bending in the members of a framed structure has led to failure. In both instances the affected structure was a bascule bridge, a structure which experiences greater stress variations than a fixed bridge. It happens also that the two bridges were of the same type. This fact, however, is of less interest than the demonstration which the two accidents give that there are dangerous potentialities in an action which heretofore engaged little more than academic interest on the part of structural engineers.

Bending effects due to truss distortion, or secondary stresses, are accorded a courtesy recognition in textbooks and in design specifications dealing with bridges, but do not often receive more serious consideration. In structures other than bridges they are practically ignored. Many engineers lean toward the view that though they may theoretically exist they have no practical meaning, certainly none comparable to load or wind stresses—in effect that secondary stresses do not involve any risk of failure of a structural member. It is therefore of decided importance to learn from actual failures that these stresses represent a tax on the material in just the same way as direct load stresses, and must receive a similar accounting in the proportioning of members.

The first case, which occurred two years ago, involved the large double-leaf bascule bridge of the Canadian Pacific Ry. at Sault Ste. Marie, Mich. Each leaf is counterbalanced by a concrete counterweight hung from the rear end of a pivoted truss or walking beam that is trunnioned on a tower over the abutment. The bottom-chord member of one of these walking beams broke square across while the bridge was being operated, and the break opened up half in inch or so. The member in question is short, wide and very rigid, and, as the truss triangle of which it forms one side necessarily undergoes repetitive distortion under the varying stresses set up during the operation of the bridge, this rigid member was subjected to severe secondary bending whenever the bridge was raised or lowered. Such bending actions, continued for several years, evidently broke the stiff chord by detail fracture. Not as much is known about the detailed circumstances as would be desirable, as the railway company unfortunately has not made public any information concerning the accident, the analysis of causes or the repair operations; but there can be little doubt that the responsible action was as outlined. This view is confirmed by the fact that some time prior to the fracture an adjoining member of similar proportions and stress relations was found to require repair because of incipient frac-

ture. Moreover, both this weakness and the subsequent fracture were close to a heavy panel-point, where secondary stresses are at their maximum.

Last month a small bascule of similar type near Montreal was the subject of an equally interesting failure, again involving the counterweight support but this time localized in the members which projected down into the counterweight and carried its load as hangers. On this case a statement of conditions was made by the designers, as printed on page 861 last week. Excessive bending stresses, the statement indicates, resulted from the removal of side plating of the counterweight and from defects of the early design. Whatever their source, their effect in producing ultimate rupture of one hanger (which in turn led to failure of the others) presents a valuable confirmation of what the Soo accident indicated, namely that secondary bending is quite capable of producing failure.

Whether the potential danger from this kind of stress is as great in fixed as in movable bridges may be open to question, as the variable part of the truss distortion is generally smaller in fixed structures. This point will probably engage the attention of practical bridge designers, a remark which also applies to quantitative appraisal of the influence of secondary stress. Even without such detailed consideration, however, we gain from the two accidents the important knowledge that secondary stresses are by no means negligible but that on the contrary they threaten the safety of structures just as truly as do the more commonly calculated stresses. In the light of this new fact it would seem that safe designing will need to take account of them by calculation, as for the direct load stresses. The procedure now prevalent of assuming that secondaries do not exceed certain percentages of the load stresses is hardly adequate to meet this requirement, especially since it is considered necessary nowadays to compute less vital actions to an accuracy of two or three places.

Associated Professions

SOME weeks ago we noted the strange situation in the State of New York whereby students of engineering are barred from aid of state scholarships and expressed some curiosity as to the theory which underlay such a peculiar law. Since then we have received a memorandum from the State Department of Education, which contains the following paragraph:

"The scholarship law provides that no scholarship shall include professional instruction in law, medicine, dentistry, veterinary medicine or theology, except so far as such instruction is within a regularly prescribed course of study leading to a degree other than in the above-named professions. Since the enactment of that law, pharmacy, chiropody, optometry, architecture, and engineering have been added to the professions and to practise in such additional professions a license from the state is required, as was true of those professions named in the original law. It was argued that if a person was to receive the manifest benefit accruing from a state license to an individual obtaining the same, the state ought not in addition thereto to contribute to the education of such individual and that the original purpose of the law was not to aid men primarily in securing an education in a school that was to prepare him for the practice of a profession but rather to encourage the higher education in those courses which are more largely literary and cultural."

The mystery as to the real reasoning behind the law becomes more involved than ever. Two things, however, are clear: First, that the state's educational directors conceive of the license to engineers as a beneficent bestowal of grace upon that profession and not as a protection to the public and second, that engineers in the State of New York now have been elevated to the same professional status as the chiropodist. We might also remark the state department's conjunction of the term "literary and cultural," though we had thought that in educational circles that synonymity was no longer accepted. The most pertinent conclusion that can be drawn from this strange combination of ambiguity and unfairness is that the New York State Department of Education needs a little educating itself in modernism.

Tardy Highway Research Records

A SIGNIFICANT comment on highway research is contained in the report of Prof. W. K. Hatt, Director, Advisory Board on Highway Research of the National Research Council:

> In the three years much progress has been made in quickening the will to research, in mobilizing the energies of research agencies and in assembling the data necessary for judgment upon questions of highway planning, construction and operation.
>
> It may be said with a large degree of confidence that at present a well trained and experienced highway engineer, in possession of available data, can select a type of highway suitable to the conditions of climate and traffic of a given situation, can specify the materials and design the section with a reasonable certainty that it will withstand the specified conditions of service.
>
> It is true that the communication of these data to engineers in general has not kept pace with the accumulation of the data nor has a working organization for the process of analyzing the data and translating the discovered principles for the use of engineers been adequately provided. The Advisory Board has published bulletins of information on existing research projects, on apparatus for research and the director has written many occasional papers. Its research committees have summarized progress. Much remains to be done, however, in unlocking the stored-up data in the files of the state highway commissions which are now such active agencies in highway research.

One who has some acquaintance with the research work being done will readily subscribe to Prof. Hatt's statement. It is the last paragraph however which commands particular attention. Research data in highway engineering and transport are being accumulated much faster than they can be communicated to highway engineers chiefly because means are lacking to undertake publication and because complete publication being thus denied there is a disposition by investigators to withhold summaries and conclusions brief enough to be given expression in engineering journals.

In most highway research investigations there is an unconscionable delay first in analyzing the amassed data and second by hoarding the results until the last drop of uncertainty has been wrung from them. It is these facts which hold back to a considerable degree financial support from commercial interests. Contributions for highway research would be far more plentiful were the donors assured of a reasonably prompt communication of results. Communication would be reasonably prompt if research workers utilized the means of communication available and trusted to future opportunity for publication of the compendious and definite report naturally craved by the investigator proud of his work.

Current Structural Research at Bureau of Standards

Many Studies of Metals and Structures Recently Completed or in Progress—Extensive Work Being Done in the Field of Cement, Brick, Hollow Tile and Stone, Including an Investigation of Stucco Foundations

MUCH WORK is going on at the Bureau of Standards that has direct bearing on the materials and design methods of civil engineering construction. Besides dealing with the properties of materials themselves, this work concerns the action of structures—from beams and columns to completed buildings and cranes—and their details. New materials or new difficulties figure in some of the work, as the duralumin members of dirigible airships, the low mechanical strength of zinc corrugated roofing, and disintegration troubles in Western sewers. Well-known constructions also present new questions constantly, as exemplified in tests of riveted joints recently begun for the Navy, and a reinvestigation of stucco with respect to the effect of foundations that is shortly to begin. Brief notes on various items of this work recently gathered at the Bureau are given in the present article.

Tests of Structures—Two interesting stress investigations of completed structures were carried out some time ago by members of the Bureau's staff, but only recently reported on. One of these was a measurement of stresses under measured floor loads in a reinforced-concrete building in Washington, the Arlington Building, undertaken primarily to give assurance of the safety of the structure after its floors had been strengthened by applying an additional thickness of concrete on top of the previously completed floors, to increase the load capacity of the floors. The tests showed that the expedient was reasonably effective.

Tests of stresses in the framework of the 350-ton tower crane at the Philadelphia Navy Yard, which were strain-gage measurements made under known loads, showed close agreement with calculated results. The tests were not fully informative because they related only to live-load stresses; dead-load stresses could not be measured because gage points had not been provided on the members before erection.

Column Tests—Much investigative work in the field of columns has been going on. In connection with test work, a theoretical study of column action along the line of Karman's attack on the problem is under way, and a restudy of the column tests carried out for the American Society of Civil Engineers seven years ago has been carried out, the latter by an outside investigator, Prof. O. H. Basquin.

The most elaborate of the column tests was a series of ultimate strength tests of about 150 members of the framework of the navy dirigible airship ZR-1, just completed at Lakehurst, N. J. Most of the members tested were of triangular cross-section, 8 to 13 in. in depth, and in 3, 5 and 10-m. lengths. About one-half of the total number were tested as columns, the others as beams or under combined column and beam loading. The column tests were made with round ends, using ball-bearing spherical blocks. In the beam tests, under distributed loading, a failing stress of about 22,500 lb. per square inch in the extreme fiber was developed, the results being quite consistent. The column tests were also satisfactorily consistent; ultimate loads ranging from 3,300 lb. per square inch for the longest columns to 22,000 for the shortest and thickest columns were obtained. The failures were substantially all flexural, that is, dependent upon the elastic properties of the material and dimensions of the structure, rather than due to passing the yield-point of the material in short-column action, and there were no rivet failures or failures caused by poor material or poor workmanship. In a few cases the buckling was integral, with bending of the column, but in most instances the section of main channel between lattice bars buckled. The longer columns, from slenderness ratio 170 down to 80, fitted the Euler curve with modulus of elasticity taken at either 9,000,000 or 10,000,000 lb. per square inch. Shorter columns showed strengths flattening away from the Euler curve to a horizontal at about 18,000 lb. per square inch. The material itself is reported to have a yield point from 30,000 to 35,000 lb. per square inch.

The fact that channel buckling was found to be the determining factor in the strength of these girders has led to an investigation of the effect of channel thickness and shape upon the buckling stress. This investigation which has just been started is expected to continue during the year.

Compression tests on 170 structural steel angles, ranging in slenderness ratio from 350 down to 50, were recently reported. In the longer angles the effect of the end connections was marked, but became less noticeable in the shorter angles where the yield point of the material became the controlling factor.

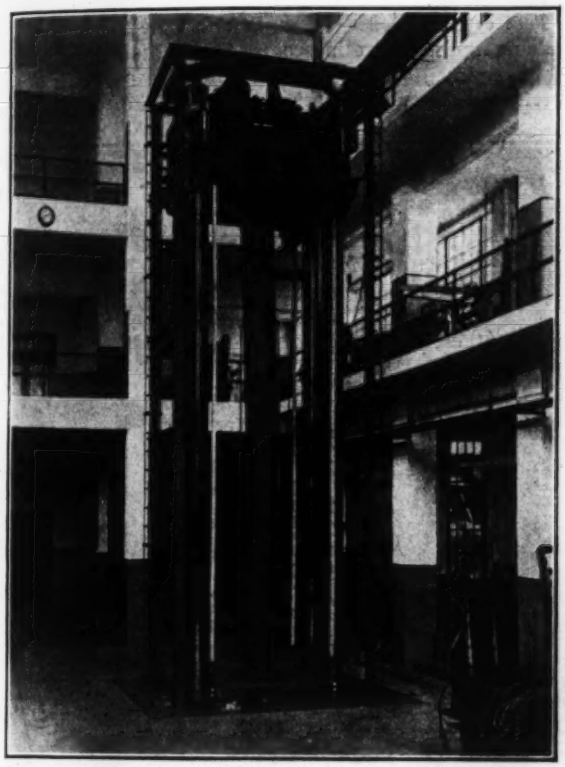
Fourteen wide-web columns were tested for the Delaware River Bridge Commission. The webs were 35 in. wide by 10 ft. long and ranged from $\frac{3}{8}$ to $1\frac{1}{2}$ in. in thickness, the thicker ones being made up of two plates. The flange angles were 6 x 4 x $\frac{3}{4}$ in., but were supported by stiff members transverse to the web plane, to prevent flange buckling. The strength of these assembled columns ranged up to 44,000 lb. per square inch, nearly all the specimens coming close to this value except one, in which the test conditions were somewhat irregular. Thorough exploration of the buckling action of the web plates was carried out, and this study appears to show that for the columns tested there is a critical value at about $\frac{5}{8}$-in. web thickness, the failure of the thinner webs being due to web plate buckling. When buckling does not occur the web remains undeformed until the proportional limit of material is reached.

Two extended series of tests of heavy structural columns were carried out for the American Bridge Co. and the Bethlehem Steel Co., including respectively about forty and thirty columns. In both series, built-up and solid-rolled column sections were included, and the length ranged up to 24 ft. and the metal thicknesses up to $2\frac{1}{2}$ in. in the flange, with total cross-sections up to 85 sq.in. In general, both series showed that difference in the strength of these columns were almost wholly due to differences in the tensile yield-point of the material. There was a wide variation in the yield-point of the material in the different specimens, but in all cases column strength was directly related to the yield-point of the material obtained in small specimen tests. Yield-

points as given by mill reports, however, could not be used in the comparison, being quite wild.

In the theoretical study of column strength in progress at the Bureau, small sized compression specimens of various lengths are to be tested, with knife-edge end-bearing carefully centered. The relation of column strength to compressive test specimen qualities will be one of the matters investigated. In the tests of large columns, above noted, only tensile specimen yield-points were available.

Tubes as Columns—A series of steel tubes of thin gage, in diameters ranging between 1¼ and 2½ in., was



COLUMN TESTING IN TEN MILLION-POUND MACHINE

This specimen is a steel column of solid rolled H-section, and withstood 3,063,600-lb. total load before failing. The dimensions and weight of this specimen are as follows: Length, 23½ ft.; sectional area, 85.1 sq.in.; total weight, 6,800 lb.; slenderness ratio, 74.0 The four vertical rods near the screws are attached to the upper head and operate dial micrometers attached to the lower head. They measure the relative movement of the testing machine heads and show any tilting as the test proceeds. Four other dial micrometers show any lateral displacement of the lower head. Four compressometers were attached to the column extending over about half its length, to measure the shortening of the column.

tested for longitudinal compressive strength. The specimens varied greatly in the tensile yield-point of the material, which was reflected in the compressive strength. Eccentricity of loading due to difference of thickness on opposite sides of the tube also was a factor, tending to produce early bending. In general, failure occurred by local buckling or crinkling rather than by integral bending.

Welding and Riveting Compared—Comparison of welding and riveting was carried on in several series of tests. Spot welded joints of plates were tested in comparison with similar riveted joints, and corresponding tests were made on plate girders and on built columns. The welding was done by two methods, in one of which the current was concentrated at the point to be welded by placing a small copper disk under the electrodes, while in the other the metal of the plate was embossed by a shallow die before applying the electrodes, for the same purpose. No perceptible difference between the two methods of welding was noted.

In plain tension tests of joints, the welded specimens showed up fully as well as the riveted, giving higher strength in a number of instances. In the tests of girders, no particular difference was observable, except that the welded girders showed about 5 per cent greater deflection than the riveted girders. The welded columns were weaker than the riveted, by about 13 per cent; this may be due to a greater flexibility corresponding to that found in the girders. In the opinion of the mechanical test department, these test series, while illuminating, were not sufficiently extensive to warrant definite conclusions as to commercial serviceability of the welding method. More extensive static tests and in connection with them some fatigue tests would be required. The fact that the welded joints in most cases showed greater elongation than the parallel riveted joints was, however, considered an important indication of the good quality of the joints.

Comparative tests were made of three welded and one riveted tank, for comparison with each other, extensometer measurements being made on the tanks. It was found that the commonly accepted theory for the design of tanks is, for all practical purposes, sufficiently accurate, provided the computed stresses are not influenced by secondary stresses. Secondary stresses which resulted in high stress intensity in these tanks were caused by (a) faulty design of the attachment of the spherical end to the cylindrical shell, (b) nonconformity of the shell to an accurate circular section, and (c) discontinuities in the shell for the manhole and fittings.

To aid in the preparation of the new A. S. M. E. Safety Code for unfired pressure vessels, over 40 welded tanks furnished by the American Welding Society were tested to destruction under hydrostatic and combined hydrostatic and hammer test. The superiority of the double Vee over the single Vee weld and useful information for the design of welded pressure tanks was shown by these tests.

Riveted Joints—An unusually elaborate set of tests on very large riveted joints has just been begun for the Navy Department. The tests have the main purpose of throwing light on the best proportion of riveted seam connections such as those used in ships' plating, when special steel is used for the plating. About 100 specimens are to be tested, each 22 in. wide, with as many as twenty rivets on a side. Three weights of plate and three grades of steel—structural, high carbon, and alloy—with rivets of medium and of high strength are included. The main objective is to determine the best distribution and the best type of joint, using up to four rows of rivets. The full program in prospect is much larger than that indicated by the above number of test specimens.

In these tests, the stress measurements will cover the middle 5 ft. of length, the test pieces being 8 ft. long overall. In addition to extensometer measurements, the cement wash method of outlining the stress line produced during deformation will also be applied. The specimens have widened ends, bolted to machine head

fittings, to make the stress distribution on the test length as uniform as possible.

Wall Tests—Walls of hollow tile were tested under endwise loading during the past year, with results just made public. The walls were 6, 8 and 12 in. thick, 4 ft. long and 12 ft. high, all laid up in cement (4) lime (1) mortar. The ultimate strength of these carefully built walls was in the neighborhood of one-third the strength of the tile tested singly, but quite wide differences in strength of the tile did not greatly influence the results, and the stress at failure (net sectional area) did not appear to depend to any noticable extent on the thickness of the wall or the size of the tile. End construction walls were about twice as strong as side construction walls. Strain-gage readings on the walls proved to be of little use. Tests on a few walls with eccentric loading applied over half the thickness of the wall gave reduced strength. These tests were reported by H. L. Whittemore and B. D. Hathcock.

Tests of brick walls and piers are to be continued. In the former, the effect of cement, cement-lime and lime ("Ideal" construction) mortars on hollow and solid walls, made of different kinds of brick, will be studied, in walls either 8 or 12 in. thick, and about 6 ft. long and 12 ft. high. The tests of piers are likely to be planned on a large-scale basis to develop the effect of bond, kind of mortar, method of laying, and the like.

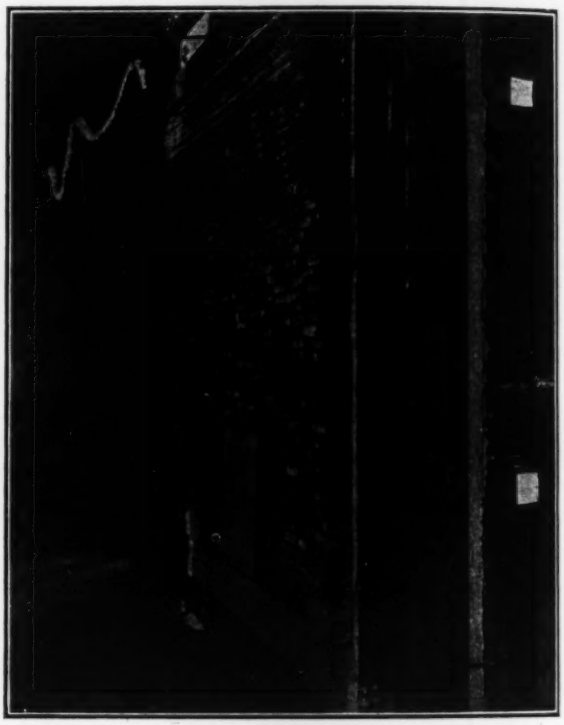
Various minor tests of special structures have been carried out that may be noted here. They include tests of wire rope sockets and tests of large capacity crane hooks of the type used in lifting girders. In the latter, it was found that design on the basis of the method used for straight beams is satisfactory. In some tests of the effect of looseness of fit between nut and screw on the tensile strength of a bolt, little effect of the tightness of fit was observed. In connection with the miscellaneous work of the Bureau in this field, mention may be made of a specification for wire rope, recently issued, representing a compilation of commercial practice to represent a high grade of commercial steel wire rope manufacture, rather than a formulation based on test results. The specification is an attempt to standardize twist, core, quality of galvanizing, and strength, for four grades of rope in both galvanized and uncoated material.

Strength of Corrugated Zinc Roofing—Among the tests in the field of special materials, strength tests of corrugated zinc roofing are included. These developed from doubts arising out of practical experience as to the proper spacing of supports for such roofing. The material when under continuous load shows slow, progressive sagging, and no conclusions have yet been drawn as to the proper working stress for design, but the present result indicates that the purlin spacing must be considerably less than with galvanized steel roofing of the same gages. In connection with these tests, fasteners such as zinc nails are also being tested.

Fatigue of Sheet Duralumin—Elaborate flexural fatigue tests of sheet duralumin are in progress, being part of a program on which work has been proceeding for several years. Thicknesses of 0.020 to 0.120 are under test, in samples about 1 in. square. Bending is applied in alternate directions, the stress being measured at each alternation by a spring gage at one end of the specimen. The applied stresses are below the tensile yield-point of the material and the tests were carried to very high numbers of repetitions. Up to the present no "endurance limit" such as have been found for ferrous alloys has been found. Material from different shipments shows marked differences in number of repetitions that it will stand at a given stress, while in other tests (tension, tensile impact, cutting, hardness, etc.) they are comparable.

In the alternating flexural tests, special care has been found necessary to avoid vibration in the case of the thinner sheets. Unusually ingenious instruments and expedients have been devised in connection with this and the measurement of bending stress while the test is in progress.

Test of Limestone—Strength and time-load tests of Indiana limestone are in progress, with the co-operation of quarrymen, with a view to furnishing a basis for specifications for engineering and building use. In the time-load tests it has been found that loads of one-half to two-thirds the ultimate do not produce progressively increasing deflections. An extensive series of tests of lifting devices is shortly to be undertaken. Waterproofing and prevention of stain are also under test.



TESTING WALLS FOR FIRE RESISTANCE

Unexposed side of 8-in. solid Eastern surface clay brick wall at the end of the 6-hour fire test.

Stucco Studies—A reinvestigation of the subject of wall stucco is being started, using different reinforcement and methods of support for the stucco. All the material is portland cement stucco; the foundations are metal lath of various types on wood frame with and without sheathing. A large number of panels are to be exposed. The work is carried on in co-operation with cement, lumber and metal lath and fabric manufacturers.

Cement and Alkali—A detailed field examination of samples of cement and concrete exposed in alkali loca-

tions during ten years is now in progress, and the results should soon be known.

Related questions are under study in connection with sewer pipe troubles reported from a Western city. Both clay and cement sewer pipe are included in the investigation. Trouble seems to localize at manholes, and to be in direct relation to the amount of hydrogen sulphide present. Brick sewers shown similar mortar trouble.

Alumina Cement—Various high alumina cements are to be made this year and exposed to alkali and sea water. Georgia bauxite will be used in manufacture.

Test Methods and Instruments—Two interesting studies of tests for metals are in progress. The Humphrey method of testing notched test specimens by slow bending is being compared with the Izod impact method, and different methods of carrying out the Brinell hardness test are being studied. One of the questions of great practical importance in connection with the Brinell test is method of determining the hardness of material when in thin sheets.

A highly sensitive optical extensometer and a distant-reading extensometer using the principle of the varying resistance of a set of carbon disks were developed at the Bureau during the past year and have been described recently (*Engineering News-Record*, Aug. 16, 1923, p. 266). The optical extensometer is to be applied on a large scale to the Navy tests of riveted joints, above mentioned, some thirty instruments having been made for this test series. The carbon-resistance extensometer has been used in stress measurements on the Navy's great dirigible ZR-1.

Fire-Resistance Tests—Walls built of clay, sand-lime and cement brick have been tested under fire exposure and fire and water exposure, in 11 x 16-ft. panels, with exposure on one side up to 6 hr. The present indication is that an 8-in. solid wall will stop the progress of severe fire, though it will crack and deflect considerably. Where combustible members are framed into the wall they decrease the fire resistance. The 12-in. wall has been proved adequate for all fire conditions likely to occur in buildings although heavier thicknesses may be necessary from the standpoint of strength and stability. A number of hollow walls have also been tested, and it is concluded that when filled at the floor line around ends of combustible members they are adequate for moderate exposures.

Fire tests of panels of hollow tile are in progress on an equally large scale. The fire resistance of walls, 8 to 12 in. thick, has been found to depend on the mineral characteristics of the clay. Thickness of shells and design are also factors. Fire resistance is increased by plaster coatings that remain in place. Repeated freezing tests indicate advantage for tile having low porosity. Load tests of the panels are also to be undertaken.

Strength at High Temperatures—Tests have begun on the compressive strength and elastic properties of materials at temperatures up to 1,000° C. Structural steel begins to decline in strength decidedly beyond 400° C. and fails under working loads between 550° and 650° C. Timber loses one-half or more of its strength at 100° C., and further rapid loss occurs beyond 150° C. Where actual failure and distortion of shape has not occurred, both steel and timber recover their strength almost completely on cooling. The rate of expansion of steel increases with temperature to values more than one-half greater than obtain at ordinary temperatures; the maximum expansion under load approximating working loads in buildings is reached at about 500° C., where the yielding due to the load more than balances the expansion.

Fire Tests of Concrete Columns—A report is soon to be made on the results of about ninety fire and load tests of concrete columns made at the former Pittsburgh station of the Bureau. The tests showed the great effect of composition of aggregate: high-silica material gave the lowest resistance, and calcareous aggregates the highest, while trap rock and slag gave intermediate resistances. Fire resistance was increased by molded and plastered protection, and by metal binder in the outer protective concrete. There was little difference between round and square columns or between vertically and laterally reinforced columns, although the tendency to separate on the plane of the reinforcement was more apparent with the latter type.

Fires in Buildings—To give information on the probable maximum intensity and duration of fires in buildings, tests have been made in a one-story brick and concrete building 16 x 30 ft. fitted up as an office, finished with different types of floor, and burned out. The results are compared with evidence given by melted metal and other fire effects in the ruins left by actual fires. Very tentatively, the tests so far indicate that buildings housing office occupancies may be subject to fire exposures equal to the first hour of the standard fire test.

Building Exits—Investigation is being made of structural conditions, exit facilities, and safety devices concerned with securing safe exit of occupants of buildings. The safety of motion picture projectors and booths has been examined, fire tests have been made of theater proscenium curtains and curtain materials. Rigid structurally framed steel curtains have been tested, and tests of flexible asbestos curtains are in progress. The latter investigation indicates that a rigid curtain designed for a lateral load of 10 lb. per square foot of proscenium opening and protected on the stage side is effective in preventing the passage of flames, smoke and dangerous temperature to the auditorium side in the time required to empty the building, with a considerable margin of safety. Its operation can be made reliable and positive under all probable fire conditions. The investigations of the flexible curtain are expected to reveal the extent to which the same performance can be given.

Fire Tests of Roofing—The fire hazard of common roofing materials is under study in a series of brand, flame and spread tests, recently begun, covering wood shingles, prepared roll roofing and shingles, and eventually metal, slate and tile. Various sizes of brands are used, with different wind velocities over the test deck produced by a propeller fan. Brand tests will also be made in connection with hot blasts representative of conflagration conditions. The sample roofs are seasoned in ovens and under ordinary room conditions. It has been found that there is a considerable difference in the flammability between oven-dry and air-dry samples of wood shingle roofing, for which reason care will be used in approximating the conditions of practice. Tests will also be made of samples of shingle and prepared roofing from old roofs weathered for years.

North Carolina to Build a State Railroad

AN UNUSUAL project now under engineering investigation is the construction by the State of North Carolina of a railroad across the Blue Ridge in the northwestern corner of the state to give a new trunk line to the west. This railroad, in connection with existing lines, will provide a direct route from the central and eastern parts of North Carolina to Cincinnati, Ohio, and the Middle West, passing through coal fields of eastern Tennessee and southeastern Kentucky, which will thus be given an outlet to the east through North Carolina. The new line will also provide communication with four northwestern counties (Alleghany, Ashe, Watagua and Avery) which are shut off from the rest of the state by this branch of the Appalachian range. These counties, known colloquially

WHERE NORTH CAROLINA WILL BUILD A STATE RAILROAD

The proposed railroad is to give the state a new western outlet and to connect the eastern section with northwestern counties now isolated by the Blue Ridge. The route has not been established but the crossing of the ridge will be probably from Elkin to Sparta, North Wilkesboro to Jefferson or North Wilkesboro to Boone.

as the "lost provinces," have no railroad connection with the main body of the state but two of them have railroad outlets to the west. The situation is shown by the accompanying map, in which all railroads are of standard gage with the exception of 3 ft. gage for the Linville River R.R. and the East Tennessee & Western North Carolina R.R. The Laurel Fork R.R. is operated for freight service only.

Since the proposed railroad will be of great public benefit but is not likely to be undertaken by private enterprise, the North Carolina legislature at its 1923 session enacted a law authorizing the construction by the state of a railroad across the Blue Ridge to be known as the Appalachian & Western North Carolina R.R. This law constituted a special commission in charge of the project and appropriated $50,000 for its use in determining by surveys and other investigations the best route for the railroad. The law also appointed individual members of the legislature to comprise the board of directors to organize the Appalachian & Western North Carolina R.R. Co., through which medium the construction and preliminary operations of the railroad will be carried on without the aid of the outside capital.

For the construction and equipment of the line, the law provides for a bond issue of $10,000,000 which is equivalent to a direct appropriation. The state will hold all the stock of the railroad company and will pay the entire cost of construction. To assist in the extension of existing short lines to connect with the new railroad, the law provides that if outside interests will subscribe 51 per cent of the cost of such extensions the state will furnish the remaining 49 per cent.

Heavy construction work and considerable tunneling will be required. Three passes under investigation are Roaring Gap on a route between Elkin and Sparta; Daniel's Gap between North Wilkesboro and Jefferson; and Deep Gap, between North Wilkesboro and Boone. Both Elkin and North Wilkesboro are on a line of the Southern Ry. running west from Greensboro and Winston-Salem, N. C., and terminating in the foothills. By any route the new line will be at least 75 miles in length. The passes mentioned are at an approximate elevation of 3,200 ft., which is that of the tableland on the west side of the range, while the general elevation of the country in foothills on the east side is about 1,500 ft. The grades are not to exceed 1 per cent (compensated) against eastbound traffic and 1½ per cent (compensated) against westbound traffic. Curvature is not to exceed 8 deg.

The work of the special commission is now more than half completed and it is expected that by next summer the board of directors will be called upon to organize and proceed with construction work. The surveys and preliminary work are in charge of Frank T. Miller, Greensboro, N. C., as chief engineer for the special commission and for the railroad.

Recording Road Maintenance Costs by Gantt Charts

Foremen's Field Report Made Simple—Computation and Charting Done in Office—Federal-Aid Costs Segregated

By H. J. Friedman
State Highway Department of Georgia, Savannah, Ga.

IT IS REQUIRED by the Bureau of Public Roads that data be kept on the cost of maintenance of federal-aid highway projects. These projects are comparatively short and it is necessary that separate costs distributed under various heads be kept on each. The method here worked out correlates the data necessary for federal-aid project maintenance costs, with various other highway maintenance costs, so as to secure figures which enable the engineer to draw the necessary conclusions for successfully directing the entire task of maintenance that falls within his jurisdiction. Incidentally this method of keeping cost data is that in use in the Georgia Highway Department division office at Savannah. It is here that cost data are assembled to the point where figures by counties or by projects are secured. The remaining work of applying the central office overhead and summarizing results for the state, is routine, and is not considered.

MONTHLY REPORT — TRUCK NO. 870

Make 1-ton Ford Location Graymont Ga., Date 10-31 1922

Time

From	to	Mileage	Hours	Classification	Description of work performed	Expense	Description of expenses Gas, oil, and grease
Oct.	1	61	10	Maintenance	Hauling Patrolmen Route 17	1 40	Gas 1.20 Oil .20
	3	40	"	"	Tractor route 17	1 00	" .10 " .10
	30	16	10	"	Lifting washouts, route 17	1 60	" .80 " .40
		551	135			15 20	

Used by R. E. Turner
Driven by E. Dunbar

To be Forwarded to Div. Office

FIG. 1—MONTHLY REPORT OF TRUCK OPERATION

Specimen "B"

DAILY TRACTOR REPORT

Tractor No. 26633 Make 10-ton Holt

Date 10-12-22 Used on project Route No. 21 County Jenkins

Distance traveled light (To or from work) _____ Miles

Distance traveled working (Pulling drag or grader) _____ Miles

Operators

Name	Title	Dragging surface, hours	Scraping ditches, hours	Travel light, hours	Repairs, etc., hours	Total hours	Rate per hour	Amount
Turner	Foreman	6				6	45	2.70
Durden	Mechanic	6				6	30	1.80
Jones	Labor	6				6	15	.90
Totals		18					18	5.40

GAS AND OIL USED TODAY

	For dragging surface	For scraping ditches	For traveling light surface ditches	Total gallons	Cost per gallon	Amount
Gasoline, gal.	24			24	.25	6.00
Oil, gal.	1			1	.50	.50
					Total	6.50

Remarks: Road in good shape for dragging

Foreman

Date

FIG. 2—DAILY REPORT OF TRACTOR OPERATION

Since figures on direct charges are turned in, in most cases, by foremen, who naturally are not accountants or engineers, a system of applying code numbers to the distribution of accounts, or any similar system, is not considered practicable. Also in the matter of indirect charges, such as repair parts for equipment, it is not practicable to make an office or field distribution on each bill, as there are too many projects or counties to which each item must usually be distributed. The system described permits the proper distribution of direct charges by foremen without code numbers or excessive mental effort, and also provides a simple method of pro-rating the indirect charges in proportion to the actual work done on each project or unit considered.

It is best to have one person, preferably the office engineer, who will hereafter be referred to as the cost accountant, handle and be responsible for the maintenance cost data. He should work up his data from information and reports furnished by the division cashier, maintenance supervisor and foremen. It is necessary that cost data be summarized in such shape that the information is in compact form and adapted to ready comparison. The Gantt chart is believed to be the best medium for this.

Maintenance cost data should cover the following phases of work:

1. Cost and performance on truck and tractor operations.

2. Cost of maintenance of completed federal-aid projects.

3. Costs, as compared with allotments, by counties or divisions.

Maintenance foremen keep a daily record, Fig. 1, covering the operation of their trucks, which is turned in to the division office the last of each month. This report covers the cost of gas, oil and grease, and mileage covered. The data for each truck are platted on a Gantt chart similar to that in Fig. 3. The item of repairs is a difficult one for the foreman to determine, as he orders parts from the division office for which he does not see the bills. This item as platted by the cost accountant is secured from the records of the division cashier. Maintenance patrol cars are handled in the same manner as trucks.

Foremen also turn in a daily tractor report on the form shown by Fig. 2. This shows mileage covered and gas and oil consumed. It is necessary to consolidate these figures for each month's operation under the heads gas and oil, and mileage. The item repairs, as in the case for trucks, is best secured from the records of the division cashier. The results are platted on a Gantt chart similar to Fig. 3.

A report is required of each foreman for each federal-aid project he works on, on any day. On this report in addition to the time of his force and its distribution, a statement is made of the mileage run by trucks and tractors, respectively. The cost accountant enters these charges as on form Fig. 4, also noting the mileage run by trucks and tractors. At the end of the month these charges are footed. From the division cashier, the total division maintenance overhead charge is secured and pro-rated on a mileage basis to each project, under the charge division overhead.

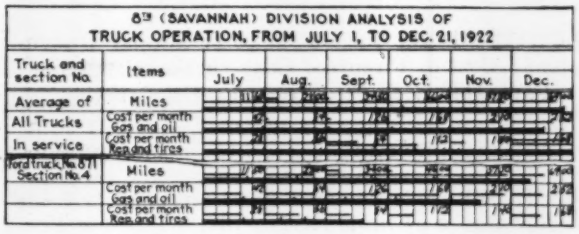


FIG. 3—TYPICAL GANTT CHART RECORD OF TRUCK OPERATION

The mileage run by each truck and tractor is reduced to a money charge and these charges, properly distributed, are shown below the footings. These charges are secured with the use of the charts, and the method is best explained by a concrete example.

Ford truck No. 674 was run 64 miles in connection with tractor operation on F.-A. Project 47, Screven County, during the month of June. The chart indicates that during June, truck No. 674 ran 1,160 miles at a cost for repairs, gas and oil, of $83. Then the charge against F.-A. 47 is 64/1160 of $83, or $4.60.

It is realized that this is not an exact figure. How-

Specimen "D"

FEDERAL-AID PROJECT COST SHEET

8th Division

County Effingham Maintenance section, No. 1

Road name F.A. Project 205 Route No. 21 Length 4.218 Miles Kind of road Sand Clay 0.007% vertical

Oct. Date 1922	Truck and Tractor Data: Truck No. 92 miles	Tractor No. 233657	Car No. 181 miles	MAINTENANCE: Dragging grading, patching, sur. joints	Cleaning ditches and culverts	Repairing bridges and culverts	Cutting brush and weeds	Building shoulders, filling washouts	Whitewashing	BETTERMENT: Guard Rails	Signs and mile posts	Rip-rap and revetment	Additional bridges culvt. and Headwalls	Planting slopes	Month's overhead $596.04	Grading	Drainage	Surfacing	Amount paid	Date	Total	Total to date

FIG. 4—FORM FOR FEDERAL-AID MAINTENANCE COST SHEET

ever, the result is well within the limits of accuracy to which the foreman can distribute his charge to the project.

The truck and tractor charges are entered below the monthly footings (which represent the direct charges and the overhead charge). A total is then struck, which represents the amount expended for the month under the different heads.

The figures secured take into consideration all costs except central office overhead and depreciation and interest charges on equipment, which should be applied from the central office on a pro-rata mileage basis.

Costs as compared with allotments by counties or divisions are obtained from the division cashier and platted as a Gantt chart similar to Fig. 3. It is necessary to make a schedule for costs per month and of mileage on which the chart is based. This is done from data on hand from past performance. If, after the chart is under way, performance shows a wide variation from schedule, the schedule may be changed at any point on the chart without difficulty.

Rochester Compares Three Types of School Buildings

Different Designs for Buildings of Similar Dimensions—Cost of Fireproof Construction Compares Favorably with Fire-Resisting Construction

By A. R. Reilly
Structural Engineer, Department of Buildings, Board of Education, Rochester, N. Y.

THE THREE types of buildings for which separate drawings were made recently by the Board of Education of Rochester, N. Y., furnish a basis for interesting studies of schoolhouse construction. Each of the three sets of drawings calls for a two-story building with accommodations for the same number of children.

Official bids were received by the board as follows:

	Cubage	Total Amount of Low Bids Without Addition	Total Amount of Low Bids With Addition
Design No. 1	1,245,917	$411,577.50	
Design No. 2	1,245,917	435,252.01	$513,016.41
Design No. 3	1,396,265	444,187.70	581,334.15

Design 1—wood joists and floors in classrooms, with fire-resistive construction in corridors, stair halls, and toilet rooms; exterior and interior walls brick bearing; hollow gypsum tile partitions between classrooms and around flues; steel beams spanning classrooms transversely at the center of rooms and under gypsum partitions; No. 24 gage "tin pan" concrete slabs for corridor floors; roof over corridors as well as classrooms of wood construction; excavation of approximately 5 ft. under the entire first floor, which space is used for steam and hot air pipes to keep the floor warm in winter.

Design 2—is reinforced-concrete skeleton supporting walls and floors; exterior walls of hollow clay tile veneered with face brick; interior partitions hollow gypsum tile except in stair towers which are enclosed in solid gypsum tile; assembly hall structural steel skeleton with fireproofing of hollow gypsum tile and brick; one-way gypsum tile floors; excavation under entire first floor similar to design 1.

Design 3—an embodiment of ideas of a consulting architect who was employed by the city of Rochester to suggest some means by which the cost of school buildings might be reduced—brick bearing exterior walls with a reinforced-concrete skeleton supporting the interior, except the assembly hall which is similar to design 2; intermediate column along the corridor side of classroom; first floor laid directly on the ground with a space for pipes in the attic and concrete plenum chambers below first floor for ventilation.

All reinforced concrete of designs 1, 2, and 3 is designed in accordance with the Joint Committee Rulings of July 1, 1916, with a few exceptions which are considered ultra conservative. The live-loads of 70 lb. per square foot for the classrooms and 100 lb. per square foot for assembly halls seem excessive according to the growing opinion on the subject. However, this department has made a study of the effect of the physical exercises carried on in our classrooms and assembly halls and is convinced that school buildings should be designed to safely carry these loads.

Although the light No. 24 gage tin-pan slabs were called for in the corridors of design 1, it is considered that this type of construtcion is not good. The pans collapse under ordinary pouring conditions, allowing concrete to run in on metal ceiling lath, increasing loads allowed for in the design, wasting concrete, giving variations in joist widths and fireproofing, and very often causing honeycomb conditions. However, the heavier cross-ribbed pans were allowed to be quoted upon for designs 2 and 3. In many cases the metal ceiling lath used in connection with tin-pan construction is subject to considerable corrosion before plaster is applied.

Floor Construction—Contractors were allowed to quote two-way tile floors as an alternate in designs 2 and 3. Although the figure on 3 was not as favorable as on 2, the reason is very evident. The slabs, having no restraint and only simple bearing at exterior walls, require an additional moment factor, involving thicker slabs and heavier reinforcement. The figure for two-way tile floors on design 2 was not received with formal bids.

There is a question in the minds of some engineers as to the advisability of reducing moment factors as suggested by the Bureau of Standards Report 220, but as the United States Bureau of Standards considers this type of floor construction safe and as we know structural formulas are theories proven empirically, there is no reason to doubt the safety of such floors. Economy is good engineering. The history of flat-slab design offers a precedent. As the system lends itself to light loads and panel dimensions of school construction, the girders along peripheries give a better distribution of loads to columns than the one-way systems, thus reducing the unbalanced moments transmitted thereto. The tie-through gives structural unity. The saving of plaster and simplicity of forms appeals to the contractor.

The intermediate column added along the corridor side of classrooms in design 3 is governed in minimum diameter by the height rather than economic design as in 2. Column forms cost more per square foot than beam forms. This, together with the saving of floor space by omitting the intermediate column, effects an additional economy of $1,200 by using design 2.

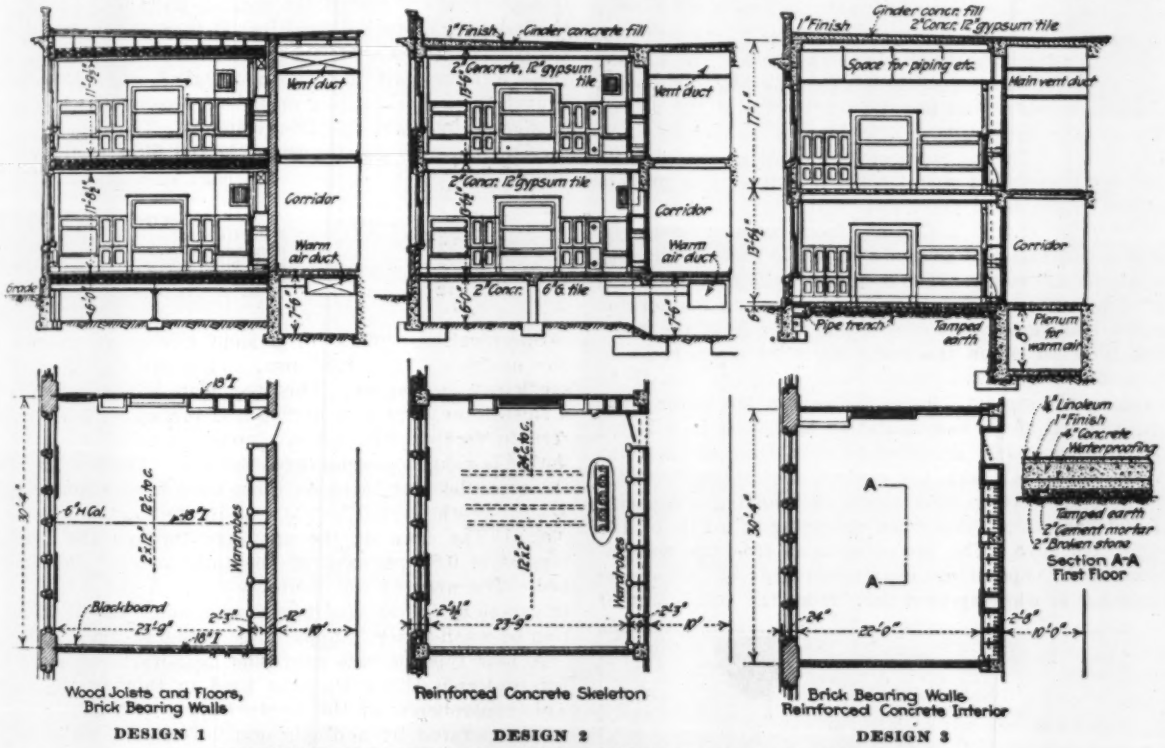
Most of the masonry contractors have enthusiastically approved of design 2 because it is possible to

complete the concreting operation before bricklayers are needed on the job. In the past it has been a piecemeal proposition involving laying off and re-employing men. It is also less expensive to lay up a 4-in. brick veneer with 6-in. hollow tile backing than a 12-in. solid brick wall. The heat loss through the former is less.

The first floor system of design 3 as indicated below, being laid directly on the ground, is not good construction. Experience has taught us that it is not only cold and damp underfoot but unsanitary. No precaution of preparation of foundation and waterproofing of strata will give to subsoil a uniform settlement. Cracking is bound to result and rotting of wood sleepers and flooring, or linoleum as the case may be, will cause a higher maintenance cost. Placing the floor on the ground requires that space for piping be furnished above the second story ceiling, which ceiling had to be

	Without Addition Design 1 Per Cent	With Addition Design 2 Per Cent	With Addition Design 3 Per Cent	N. E. A. Average Per Cent
Walls and partitions	7.10	6.80	6.94	10.00
Flues	1.80	1.75	1.54	3.00
Corridors and stairs	22.70	20.15	22.02	20.00
Accessories	0.00	0.00	0.00	1.00
Instruction	54.70	59.00	55.00	50.00
Administration	13.70	12.30	14.50	16.00
	100.00	100.00	100.00	100.00

Much could be said about maintenance and more thought should be given to it. The first design is not the structural unit that the second is, so naturally more unequal settlements and cracking of plaster, brick-work, terrazzo, and tile work can be expected. The third, with its first floor on the ground and its exterior bearing walls lacking the "tie-through" of the second, will have unequal settlements. The fire hazard in the first is much greater than in the other two, and the spending



DESIGN 1 DESIGN 2 DESIGN 3

COMPARATIVE DESIGNS OF SCHOOL BUILDINGS FOR ROCHESTER, N. Y.
Typical plan and cross-section of three buildings differing only in structural details.

designed to carry a live-load for the repairing of pipes. Metal ventilation ducts in the excavated basement of design 2 had to be replaced by concrete plenum chambers in 3. In the latter, cross branches and conduits required concrete trenches under the first floor slab. The attic of design 3 naturally involves a higher building and more exposed wall area.

Division of Floor Areas—It should be noted that design 3 calls for a reduction in the width of classrooms from 23 ft. 9 in., Rochester's standard, to 22 ft. 0 in. Wardrobes are within the rooms along the corridor side. "The Candle of Efficiency" as published by the Committee on Standardization of School Buildings of the National Education Association was applied to all three designs. The following table shows the division of floor areas in percentages according to the above named standard:

of an additional $2,500 to complete the sprinkler system in it would further reduce the difference in cost between design 1 and design 2.

The figures received indicated that 85 per cent ($58,100) of the economy of design 2 over 3 was in the masonry work. The heating, electrical, and plumbing figures showed an economy for design 2 over 3 of approximately 3 per cent, plus the cost of ventilating ducts of design 2. This was largely due to the fact that the exposed wall area of the former is 8,300 sq.ft. less than in the latter. The saving is slightly offset by the better facilities for piping and conduit work in the attic of design 3.

Although it is not prudent to draw definite conclusions from isolated cases, yet the economy of a reinforced-concrete skeleton for school buildings is so positive that it should appeal to the structural engineer.

The 8-M.G.D. Sioux Falls Iron-Removal Plant

One of the Largest Iron-Removal Plants, Built at Low Cost, Has Small Hand-Operated Units and False Bottom Underdrains

By F. G. Gordon
Principal Assistant Engineer, with Dabney H. Maury, Consulting Engineer, Chicago

STRICT economy dictated the use of several of the more unusual features in the new 8-m.g.d. iron-removal plant at Sioux Falls, So. Dak., built at a cost of $11,125 per million gallon capacity. Small filter units permitted hand operation of the valves. Recording water-level gages on the filter effluent line replace the ordinary integrating loss-of-head gages. A spent wash-water storage sump spreads out the discharge so that a smaller drain answers. The underdrains consist of a steel plate false bottom, into which nozzles are screwed.

Before preparing final plans an experimental plant was operated to determine whether aeration, followed by sedimentation and filtration but without the use of chemicals, would remove the iron satisfactorily. As the results with the experimental plant indicated a 96 per cent removal, it was decided to employ this process in the contemplated plant.

The water supply is obtained from large shallow wells sunk in an excellent gravel stratum located in the Big Sioux River valley. From these wells the water is lifted by motor-driven centrifugal pumps to the aerator in the iron-removal plant. The aerator is of the weir-step type, in which the water cascades down concrete steps on which removable 1½-in. pipe are placed to break up the stream. From the aerator the water flows into one end of the sedimentation basin and is collected at the other end by an overflow weir, from which point it passes to the filters.

There are sixteen filter units, each having a capacity of 500,000 gal. per day when operating at a rate of 125 m.g.d. per acre. The use of units of this size was influenced by operating conditions and by structural reasons. It was expected that, from the standpoint of hand operation which had been decided upon, it would be easier to operate the valves for the plant as designed than to operate the fewer but larger valves of a plant having larger units. The iron-removal plant was built directly over an existing reservoir, in which the column spacing and design combined to make advantageous the construction of filter units of the size used. Certain iron-removal plants in the past have experienced difficulty with a growth of crenothrix in the sand. It was thought that the use of the smaller units would enable the handling of such difficulties (if they occurred) more easily than in units of larger size.

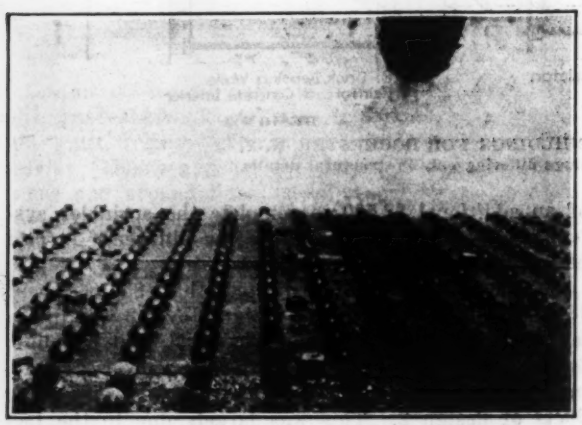


FIG. 1—STEEL PLATE FALSE FILTER BOTTOMS
Cast-iron umbrella-shaped nozzles are screwed onto brass nipples screwed into the steel plate. The plate is supported 20 in. above the floor by U-shaped cast-iron posts with a 1½-in. holding-down bolt in the U.

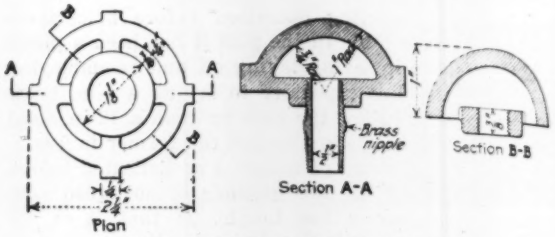


FIG. 2—DETAIL OF FILTER NOZZLE

Each filter unit has 30 in. of sand and 15 in. of gravel, the gravel resting on a ½-in. steel plate which is supported by short cast-iron columns. The gravel was screened to size and deposited in the filter in the following layers:

Thickness of Layer	Size of Gravel
5 in.	2 in. to 1 in.
3 in.	1 in. to ½ in.
3 in.	½ in. to ⅛ in.
2 in.	⅛ in. to $\frac{1}{16}$ in.
2 in.	$\frac{1}{16}$ in. to size passing No. 10 sieve

Specifications called for a sand having an effective size of from 0.35 to 0.50 mm., and as low a uniformity coefficient as possible. The steel plate which serves as a false filter bottom is drilled and tapped on 6-in. centers to receive ⅜-in. brass nipples, to which cast-iron umbrella-shaped nozzles are screwed. The design of these nozzles was based on those used by the American Water Works and Electric Co. in its East St. Louis plant. The area of the openings through the brass nipples is 0.53 per cent of the total area of the filter bed. The area of the openings through the nozzles is in excess of the area of nipple openings. The distribution of wash-water is apparently very uniform.

A new type of rate controller manufactured by the International Filter Co. was used in this installation. This controller is of the Venturi type, with a butterfly valve operated by a diaphragm. Tests, in which the head on the inlet side was varied from 2.5 to 5 lb. in an interval of one minute, showed a variation in discharge of less than 5 per cent.

Recording water-level gages were used for loss-of-head gages. The gages for adjoining filters were mounted back to back on 1-in. gage boards located on the operating floor. Although this type of gage is not differential in its action, it gives a satisfactory record because the water level in the filters is carried within a few inches of the same elevation at all times.

Since a single wash-water pump is provided, for emergency use a connection is made to one of the high service mains leading from the pumping station to the distribution system. The friction loss through this connection was carefully calculated, and the size of the pipe selected so that the wash-water pressure when delivering a sufficient quantity for washing purposes would not be excessive.

A sump having a capacity of 40,000 gal. was con-

structed to receive the wash-water from the filters. The construction of this sump permitted the use of a 10-in. cast-iron drain from the sump to the nearest city sewer instead of the 16-in. drain which would have been required if the sump had not been built. The saving due to the use of the smaller drain amounted to $5,887, while the cost of the sump was only $1,617. Cast-iron construction for the drain was necessary because of its proximity to the gravel stratum from which the water supply is obtained. The Champaign and Urbana Water Co. has had a similar arrangement in service for a number of years, but its sump is used with the idea of reclaiming a large part of the wash-water.

The office, laboratory and pump room are located at the front of the filter plant building. The pumping equipment, which is all motor-driven,

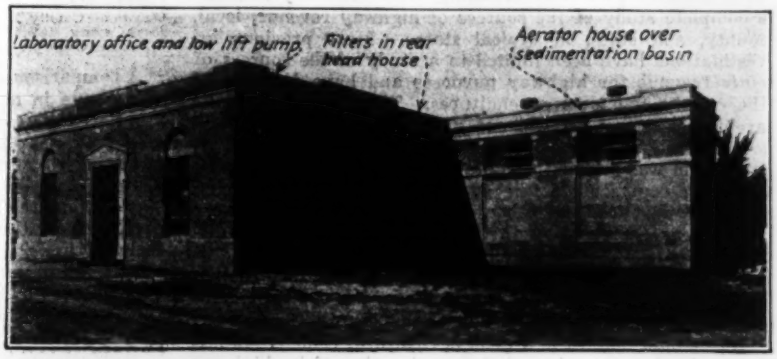


FIG. 3—BRICK SUPERSTRUCTURE OF SIOUX FALLS 8-M.G.D. IRON-REMOVAL PLANT

Aerator house surmounts concrete sedimentation basins at left. Filters are in rear of the brick head house (at right) in which are located a laboratory, office and the low-lift pumps.

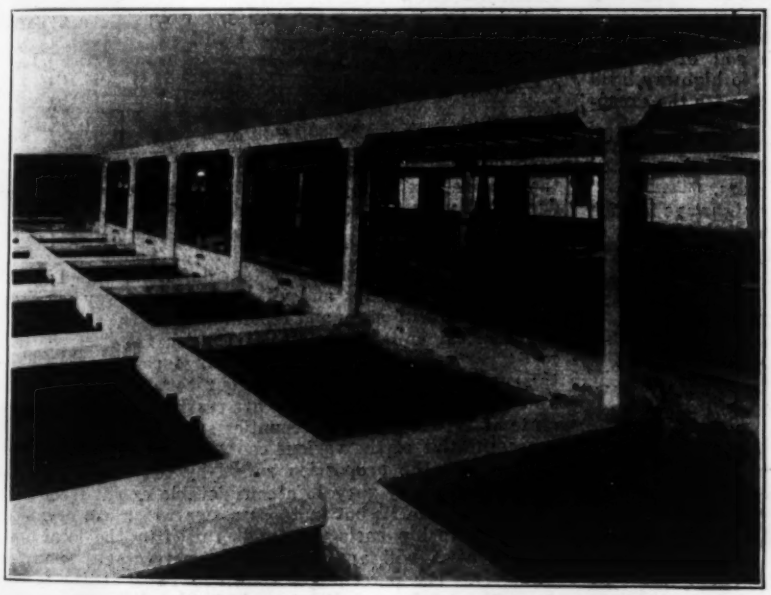


FIG. 4—INTERIOR OF FILTER ROOM WITH OPERATING GALLERY IN REAR

Struts, acting as walkways over filters, cut in half effective length of beams at tops of filter walls. Depth recording gages are mounted back to back on pipe supports. Since valves are hand operated no operating tables are needed.

consists of a wash-water pump, three auxiliary low-lift pumps, which can be used as boosters to assist the well pumps during the periods of low ground water, and one high-service pump.

The concrete used in the filter tanks and in the walls of the sedimentation basin consisted of one part of cement to five parts of coarse and fine aggregate. In determining the proportion of fine to coarse aggregate, sieve analyses were made of both classes of material. The theoretical proportions first adopted were those which would give a smooth curve of parabolic form when the quantity of material passing the various sieves was platted. It was found, however, that a more plastic concrete could be obtained by the use of slightly more fine aggregate and less coarse aggregate than the theoretical curve indicated. The slump test was used to control the amount of water in the concrete. Concrete was mixed for 1½ min. after all ingredients had entered the mixer and was placed with two-wheel carts. As the concrete for the walls of the sedimentation basin was deposited during the winter, the materials and water were heated and the concrete placed in forms which were protected by heavy straw mats on the weather side. Salamanders were used on the interior.

No trouble was experienced in putting the plant in operation, and operating results up to the present time have been entirely satisfactory. The raw water has an iron content of 4 to 5 p.p.m., while the filtered water shows 0.15 p.p.m. A greater reduction in the iron content of the filtered water will probably be obtained when the most desirable rate of wash, quantity of wash-water and time for washing have been determined. At the present time the amount of wash-water used is about 2 per cent of the amount of water filtered. The filters are washed at a rate which gives a 24-in. vertical rise per minute.

John Mundt, the commissioner in charge of the Sioux Falls Water Department, through persistent advocacy of the plant over a period of years, was largely responsible for its construction. The plant was designed in the office of Dabney H. Maury, consulting engineer, Chicago. The resident engineer was Paul G. Windt.

Minnesota Drainage Work Is Slack

Land drainage activities in Minnesota during the year ending June 30, 1923, were at a low ebb. According to a statement by E. V. Willard, commissioner of the State Department of Drainage and Waters, this slackening in the reclamation of wet and overflow lands was due to three years of abnormally low precipitation combined with the poor economic situation among the farmers. Revival of drainage work in the past few months indicates that prosperity is returning, particularly in the southern part of the state, but it will take a year of heavy rainfall to restore normal activity.

Studies in Highway Traffic and Findnce

Abstracts of Committee Reports to the Advisory Board on Highway Research of the National Research Council, Presented at Meeting in Washington, Nov. 8-9, 1923

Sources and Expenditure of Highway Funds

By J. G. McKay
Bureau of Public Roads, Washington, D. C.

BEFORE decision as to the justice or expediency of methods of highway financing, it is necessary to make a complete study of the sources of highway revenue, local, county, and state, in typical states. Most previous investigations have been limited to a study of the sources of *state* revenue for highway purposes and have disregarded the *county* and *local* expenditures. The following results are based on an analysis of *all sources* of revenue and expenditures in four Wisconsin counties from 1915 to 1921. Wisconsin was selected as a state whose system of highway financing represents a fair average of methods of raising highway revenues in other states. The counties were selected as representing the highway development in different sections of the state.

Dane County is a well populated, rich agricultural county, with no highway bond issues. Madison, the capital city of the state, is located in the center of this county.

Outagamie County is a good agricultural county. It has financed a large portion of the construction of its highway system through bond issues since 1916.

Rusk County is located in the newer section of the state. It is a purely agricultural county with soil of average fertility but as yet largely undeveloped. No highway bond issues have been made and its highways are, with the exception of the state trunk highways, largely unimproved.

Waukesha County lies west of the city of Milwaukee and is a rich dairying and manufacturing country. It has floated large bond issues during the past three years.

Table I shows the total expenditures for highways in each county. It is evident that the proportion of the burden of all highway expenditures which rests upon real property varies from 55 per cent to 70 per cent. The highest proportion is found in Rusk County, relatively undeveloped, while the lowest proportion is found in Waukesha County, a very rich section both agriculturally and industrially. This variation is due largely to differences in revenue derived from the income tax. In the richer counties the income tax furnishes a larger portion of the total revenue, and as a result, insofar as funds for highway expenditures are taken from general revenues, the income tax furnishes a larger portion of revenue for highway expenditures. It will be noticed that real property taxation and "other revenue" taken together furnish almost the same proportion of revenue for highway expenditures in all counties. The figures are as follows:

TABLE I—PERCENTAGES OF EXPENDITURE FOR HIGHWAYS IN FOUR WISCONSIN COUNTIES

	Total	Local	County	State	Federal
Dane County					
Total	100.00	100.00	100.00	100.00	100.00
Real property taxation	60.29	74.06	66.99	37.73	.....
Personal property taxation	11.20	12.06	13.51	8.71	.....
Other revenue	16.53	9.47	19.26	4.50	100.00
Automobile license fees	10.08	.....	.....	49.06	.....
Special assessments	1.82	4.41	.....	.....	.....
Miscellaneous contributions	0.08	.....	0.24	.....	.....
Outagamie County					
Total	100.00	100.00	100.00	100.00	100.00
Real property taxation	63.27	66.57	71.82	36.67	.....
Personal property taxation	13.54	11.52	17.14	8.41	.....
Other revenue	16.59	20.53	11.04	3.95	100.00
Automobile license fees	6.12	.....	.....	50.97	.....
Special assessments	0.48	1.38	.....	.....	.....
Rusk County					
Total	100.00	100.00	100.00	100.00	100.00
Real property taxation	69.83	82.04	81.68	35.70	.....
Personal property taxation	10.23	10.17	13.48	8.07	.....
Other revenue	11.52	7.46	4.84	2.47	100.00
Automobile license fees	8.26	.....	.....	53.76	.....
Special assessments	0.16	0.33	.....	.....	.....
Waukesha County					
Total	100.00	100.00	100.00	100.00	100.00
Real property taxation	55.29	64.18	72.88	38.45	.....
Personal property taxation	10.19	10.59	13.90	8.70	.....
Other revenue	23.39	24.66	13.22	2.73	100.00
Automobile license fees	10.90	.....	.....	50.12	.....
Special assessments	0.23	0.57	.....	.....	.....

	Per Cent
Dane County	76.82
Outagamie County	79.86
Rusk County	81.35
Waukesha County	78.68

A comparison of the proportions furnished by each source of revenue in any one county for the different years substantiates the conclusion that the contribution of real property varies inversely as the contribution of other revenue. Other revenue as the name indicates is made up of all sources of revenue except the sources listed separately in Table I, but the principal part of it is made up of revenue derived from the income tax. The other sources of revenue included under this head such as fees, fines, etc., form a very small proportion of the total in this class. The annual expenditures by counties from each source of revenue show that in the years 1917 and 1918, when the receipts from the income tax were highest, the proportions of revenue derived from real property taxation were smaller than in the years when the receipts from the income tax were smaller.

TABLE II—PERCENTAGE OF TOTAL REVENUES FOR HIGHWAY EXPENDITURES RAISED BY VARIOUS GOVERMENTAL UNITS

County	Local Funds	County Funds	State Funds	Federal Funds
Dane	41.27	32.81	20.54	5.38
Outagamie	34.88	49.63	12.01	3.48
Rusk	48.20	30.37	15.36	6.07
Waukesha	39.56	29.55	21.76	9.13
Average	40.98	35.59	17.42	6.02

Table II indicates the importance of funds raised by the local units (townships and villages) for highway purposes, as compared with state and federal funds. The funds raised by the local units and counties furnish from 69 per cent to 84 per cent of the total highway expenditures. While this analysis is based on only four counties it is safe to assume that these proportions are reasonably correct for the state of Wisconsin as the counties studied were selected as representative of the various counties within the state. In other states the proportion raised by the various governmental units may vary to a considerable extent from those shown in Table II, but in those states which are organized on the township basis the funds raised by the local units and counties will approximate the percentages shown in Table II. The percentages shown in Table II are derived from the total expenditures within the different counties for the period 1915 to 1921 inclusive. It should be noted that this period includes a few years before the period of federal aid, and also that the activity of the state in the highway field has increased greatly during the later years so that had the period been made to include only the years 1918 to 1921, the percentages derived from state and federal funds would probably have been larger.

The proportions of highway expenditures contributed by local, county, state and federal units, as indicated in Table

TABLE III—PERCENTAGE OF TOTAL REVENUE FOR HIGHWAY EXPENDITURES FROM REAL PROPERTY TAXATION LEVIED BY VARIOUS GOVERNMENTAL UNITS

County	Local Taxation	County Taxation	State Taxation	Federal Government	Total
Dane	30.56	21.98	7.75	.....	60.29
Outagamie	23.22	35.64	4.41	.....	63.27
Rusk	39.54	24.81	5.48	.....	69.83
Waukesha	25.39	21.54	8.36	.....	55.29
Average	29.68	25.99	6.5	.....	62.17

II, may vary to a considerable extent in different localities, nevertheless the figures are conclusive evidence that any discussion of highway finance which treats exclusively of state and federal expenditures, omits local and county expenditures which constitute the major portion of the total highway expenditures. While it would be advantageous to have more of our highways entirely financed and constructed by the state, *the fact remains that at the present time local and county highway expenditures absorb the major portion* of funds raised from all sources for highway improvement.

While the general property tax is the most important single source of revenue for highway expenditures in all units—the townships, the county and the state—its importance as a source of highway revenue is much greater in the township and county than in the state. As will be noted from Table III real property taxation by the local units furnishes from 23 per cent to 39 per cent of all highway expenditures, and county real property taxation provides

TABLE IV—PERCENTAGE OF REAL PROPERTY REVENUE FOR HIGHWAY EXPENDITURES LEVIED BY GOVERNMENTAL UNITS

County	Local	County	State
Dane	50.70	36.45	12.85
Outagamie	36.70	56.33	6.97
Rusk	56.62	35.52	7.86
Waukesha	45.93	38.95	15.12
Average	47.49	41.81	10.70

from 21 per cent to 35 per cent of the total highway expenditures, while state real property taxation provides only from 4 per cent to 8 per cent of the total highway expenditures.

Table IV shows the proportion of real property taxation revenues for highway expenditures raised in each county by the various units. An average of 47.49 per cent is raised by the local units, 41.81 per cent by county units and 10.70 per cent by the state. *The real property revenue for highway expenditures raised by the state in comparison with local and county real property revenues is but a small share of the total real property revenue raised for highway improvement.*

It is to be noted that real property taxation produces seven times as much of the total highway revenue as that derived from motor vehicle license fees, while the taxation of incomes (other revenue) produces approximately double the amount raised by vehicle license fees. Since local funds are expended on purely local roads, it is fair to compare the amount of county and state real property tax funds produced for expenditures on state and county highways with the amount raised by vehicle license fees used on the same highways. County and state real property taxation produce 32.49 per cent of total highway revenue, vehicle license fees 8.84 per cent. Real property which contributes 62 per cent of all highway expenditures produces for county and state highways four times as much of the total expenditures as that produced from vehicle license fees.

The conclusions based on this analysis of the sources and expenditure of highway funds in four representative Wisconsin counties are as follows:

1. The major portion of the total of highway funds in Wisconsin during the seven-year period from 1915 to 1921 was raised by township and county units rather than by the state.

2. Real property taxation was the chief source of highway revenue producing an average of 62.17 per cent of the total local county and state highway expenditures.

3. Vehicle license fees produce 8.84 per cent of the total highway expenditures.

4. Real property taxation for highway purposes bears too large a portion of the burden of highway expenditures, producing from 55 per cent to 70 per cent of the total highway revenue.

5. The major portion of the burden on real property is due to local and county taxation of real property for highway purposes. The local units produce 47.49 per cent, county units 41.81 per cent and the state 10.70 per cent of the real property revenue for highway expenditures.

6. Real property contributes a larger share of highway revenue during periods of depression, when the revenue from

TABLE V—SOURCES OF HIGHWAY REVENUE FOR TOTAL HIGHWAY EXPENDITURES

Source	Average Percentage
Real property taxation	62 17
Other revenue (largely income tax funds)	17 01
Personal property taxation	11 29
Vehicle license fees	8 84
Miscellaneous	0 69

other sources decreases. This results in an excessive levy on real property owners since the tax levy on real property is paid from income derived from the property and in periods of low prices this income is reduced at least as much as income from other sources.

7. When income tax funds increase within a county, real property taxation for highway purposes decreases.

8. As a county develops and grows richer the relative burden on real property for highway purposes decreases. When a county or state is in the developmental stage the cost of the permanent features of highway improvements can be economically financed by issuing a limited amount of deferred serial highway bonds. By this method the burden on property is lightened during the early years of the improvement, increasing with the ability of property to produce more revenue as a result of the highway improvements.

9. A reduction or elimination of state taxation of real property for highway purposes in Wisconsin would not materially reduce the total of real property taxation for all highway purposes.

10. Reduction of real property taxation for highway purposes in Wisconsin would result largely in a reduction of local and county taxation of real property for towns'[illegible] and highway expenditures.

* * *

Highway Traffic Analysis

By G. E. Hamlin
Connecticut Highway Commission, Hartford, Conn.

IT IS NECESSARY to differentiate between a highway traffic census and a highway transport survey. The traffic census will give information pertaining to the traffic using the highway at the time the census is taken and the purpose of the highway transport survey is to determine the probable amount and character of the future traffic which will use a given highway during the lives of its several component parts. Up to the present time, the information collected by the various states has given traffic census information and no state has extensively taken up the highway transport survey.

A highway traffic census is of value only for determining conditions which exist at the time the census is taken. It may be that by the construction of a new section of road, the general trend of traffic may be radically changed in any particular locality. After an extended highway traffic census, it is recommended that additional counts be taken at critical periods of the year in succeeding years from which, after a number of counts have been taken, curves of natural increase can be plotted from which can be roughly determined an estimate of increased traffic for a reasonable period of years. This estimate should also include the curve of increase of motor vehicle registration which can be determined at the present time in every state. It is questionable if such a curve can be applied to other than the locality in which it is developed. In fact, even in a state of small area, different curves will have to be developed for different sections of the state, rather than to utilize a general curve for all of the main highways. Up to the present time it has been found impracticable with the data available, to develop a formula of this character.

The value of an extended traffic survey in determining the allocation of construction and maintenance funds in the development of a highway system is unquestioned. Such traffic survey, however, should be utilized for type and strength of surface, rather than for location of expenditures inasmuch as the development of new territory within a state is as much a demand upon the expenditure of highway funds as the taking care of traffic already developed. This

point cannot be stressed too strongly, for, if the allocation of funds depends wholly upon the volume of traffic, only a few of the roads in any particular state would ever receive a construction allotment. This is where the decision of the engineer in charge is valuable and this decision must be based on potential as well as present traffic conditions. In other words, he must minimize any particular locality to consider the value of transportation in the whole state and each construction unit must be based on his vision of the value of such unit.

To carry out a traffic survey successfully much planning must be done preliminary to the actual field work. Stations must be chosen which will give the average condition along each highway and these must be located at a sufficient distance from the congested centers to eliminate as far as possible the strictly local traffic which will not enter into the construction program. Care should also be taken to establish stations where traffic is divided so that the value of each section as well as each road may be determined. Each station should be occupied at least one day each month, for an eight- to twelve-hour period. This should be arranged so that the same station will be occupied successively on different days of the week and on a different hourly basis to determine daily as well as seasonal variation of traffic. Blank forms where check marks may be used will reduce the time required for gaining information and names of cities, character of loading and make of truck or car may be coded, thus simplifying actual compilation of office records.

In the state of Connecticut the cost of three parties operating over a year's period with varying numbers, including necessary automobile transportation, board allowance, etc., has been about $27,000.

* * *

Motor Truck Transportation in New England

By J. G. McKay
Bureau of Public Roads, Washington, D. C.

THREE groups of agencies in New England are engaged in the transportation of people and commodities: steam and electric rail lines, boat lines, and highway transportation companies.

From September to December, 1922, over a million net tons of freight were transported by motor trucks over the Connecticut highway system. Rail service during this period was below par due to labor difficulties, and naturally this situation increased the volume of highway transportation above the normal level. The largest portion of motor truck net tonnage movement was limited to the short haul zone: 69.4 per cent was hauled less than 30 miles, 18.4 per cent from 30 to 69 miles, and 14.2 per cent over 70 miles.

Two factors are in general responsible for the highway transporting of commodities over 20 miles: (1) The lack of rapid and efficient rail service enabling shippers to obtain fast rail transportation of l.c.l. freight. (2) A limited number of commodities which are especially adapted to motor truck shipment and will probably continue to be shipped by truck for distances beyond the short haul zone. The total ton volume of these commodities is not very significant.

Since January, 1923, the per cent of the total net tonnage transported by motor truck beyond 30 miles has decreased, indicating that with efficient rail and boat service the motor truck is not a major transportation factor in the middle distance and long haul zone.

The commodities transported by motor trucks on the Connecticut highways reflect the industrial production of New England. Of the total net tonnage 73.6 per cent are manufactured goods, 8.5 per cent products of agriculture, 7.1 per cent of animals, 6.7 per cent products of mines and 4.1 per cent products of forests. The large per cent of manufactured goods is partly explained by the fact that more profit can be made in motor truck transportation of these goods than by moving bulky goods of lower value.

In general manufacturers ship their commodities by motor trucks for two reasons: (1) Prompt and reliable service and (2) Trade demands. Railroad freight congestion and rail embargoes force manufacturers to ship their products by motor trucks in both the short and the long haul zone.

A combination of motor truck and rail and motor truck and boat service is a modern development. This service has developed largely in response to the demands of shippers for a rapid pick-up and delivery service of freight. The motor trucking company assembles the commodities and loads the freight cars which are forwarded daily regardless of whether they are loaded to capacity or not. The cars are shipped by rail to destination and the trucking company unloads and delivers the freight.

The second type of joint service is a combination motor truck and boat service which has developed very rapidly in the past few years. In most cases this service is limited to over-night delivery from New England points to New York City. The Starrin-New Haven line operating between New Haven and New York City is the best illustration of this type of service. This company maintains a sidewalk pick-up and delivery from Derby, Shelton, Ansonia, Seymour, Beacon Falls, Naugatuck, Waterbury, New Britain, Meriden, Wallingford, Middletown and Hartford, Connecticut, to New Haven, Connecticut, and ships by boat from New Haven to all points.

Highway transportation of freight and passengers is increasing in volume each year. Its development has been so rapid and the information as to its movement is so meager that it is extremely difficult to lay down any definite principles as to the economic sphere of motor trucking companies engaged in the highway transportation of freight. The following is a tentative outline of the economic fields of motor truck transportation as a correlated part of our transportation system:

1. Organized urban motor truck transportation in congested terminal areas consisting of motor truck terminal to terminal freight transfers as well as pick-up to delivery service. This can be illustrated by the operation of the U. S. Trucking Co. in New York City in co-operation with the Erie R.R. in the transfer of freight from the Erie-New Jersey terminal to New York City for delivery. Carefully organized and efficiently operated motor trucking companies, assured of rail and steamship co-operation, will materially speed-up terminal freight movement, decrease the volume of freight warehoused, reduce the cost of moving freight through terminals and expedite the rail delivery time of l.c.l. freight.

2. The organization of motor truck freight service to supplement and extend existing rail and water transportation agencies. The development of motor transportation companies in areas inadequately served with rail or water transportation offers an enormous possibility for the economic extension of highway transportation. This type of service is especially desirable in the development of new areas or localities with insufficient transportation facilities and will make available additional tonnage for movement by rail or water. This is a non-competitive service extending and supplementing existing rail and water agencies.

3. The short haul transportation of freight probably not to exceed 30 miles. The freight transported by motor trucks in the short haul zone is largely a non-competitive assembly and distribution of commodities. The differences in the density of population in different areas, the distance between cities and areas of production and distribution, the prevailing type of production and the type of rail or water transportation available may decrease or increase the above zone of the short haul.

4. Motor truck transportation of a limited number of special commodities in the long haul zone in which delivery time, the character of the goods transported or the demands of the industry or trade, indicate the desirability of motor truck transportation. This type of freight is but a small percentage of the total net tonnage transported over the highways.

Through the Reclamation Country

By F. E. Schmitt
Associate Editor, *Engineering News-Record*

THIS is the ninth of the series of letters written by Mr. Schmitt during a journey recently made through the West in which he visited irrigation projects, studied developments, and interviewed builders, operators and settlers, in order to present to our readers the actualities of reclamation as revealed to an unprejudiced investigator.

The series of letters began in the issue of October 4.

Phoenix, Ariz.

MANY special views of reclamation are afloat in this great West. They appear peculiar to the visitor. Some of them are connected with past reclamation policy and some with future policy; many are related to what is often called the repudiation sentiment of the project farmers. A general appraisal of present reclamation difficulties is bound to encounter them and take them into consideration. And if they are important in their bearing on project operation they are very much more important with respect to future expenditure of national funds for reclamation.

National Duty—Stated in most general form, one Western sentiment is that it is the nation's simple duty to irrigate Western lands. Homestead lands in the Mississippi valley have a natural water supply, and Western lands should be turned over to the homesteader in equivalent condition. Suppose the hardfisted early irrigators did build their own ditch systems—that is no reason why under modern conditions the government should fail to recognize its duty to put water on the land for the farmer.

A slightly different view is that the Reclamation Fund does not belong to the United States but belongs to the West, and more specifically to the individual states, since it was raised by the sale of national lands situated in these states and wrongfully withheld by the nation from these states. One prominent citizen in particular argued this view to me vehemently and with a refreshing disregard of the customary amenities.

A third view, or rather an attitude (perhaps unconscious), of many reclamation farmers is that reclamation is not designed primarily to help the farmer or land owner, but is designed to help the United States as a whole. The entire business of reclamation, under this view, is essentially Uncle Sam's own private game, which he started for his personal purposes and which he is morally bound to see through. In less extreme cases, this view takes the form that Uncle Sam was not entirely selfish in the matter but that he does occupy the position of a sort of parent or guardian, and that, having also the biggest stake in the project, it is his plain duty to make the farmers prosperous and happy without regard to account-book questions. This has been called the Santa Claus idea of the government's part in reclamation.

Repudiation—Woven all through the fabric of thought on the projects is a widespread and definite element of repudiation sentiment. No one likes to admit it in terms; it is quite intangible; but it unmistakably colors the reclamation sky. One way of describing the sentiment is to say that those who hold it would be pleased if Congress passed a law or if some other thing happened to relieve them of the necessity of paying for the cost of the irrigation works. Another way is to say that the active repudiationist directs all his agitation and scheming and arguing toward proving that he never promised to pay, that he can't pay, that the engineers lied about the cost of the work and executed it incompetently, that costs have been negligently and fraudulently piled up, that waterlogging and the further expense for drainage resulted from the negligence of the engineers or even from the vengeful spirit of the director, that the Reclamation Service is responsible for exorbitant freight rates, and that the country at large has already put many times the alleged debt of the project farmers into its pocket in the shape of taxes and assessment rolls due to the growth of the project.

The ordinary man may find it hard to understand how the farmers, or any considerable number of them, can knowingly try to evade an obligation that they willingly assumed. But the matter of the obligation is not quite so simple. It would be simple if concerned with *homestead lands taken up after completion* of the works and announcement of their cost, which condition almost never occurs, however. Under the usual circumstances, the private owner or the early homesteader was not told what the works would cost, and such advance guesses as were made were often inadequate, so that in the end he found himself in for much more than he expected, a condition which everybody dislikes. Moreover, the law requires the farmer to pay the "estimated cost," and he thinks this refers to the advance guesses (often referred to as promises) rather than to the final estimates. He knows that the law does not create an inherent obligation anyway, but represents only a formal requirement on the part of Congress, which requirement has already been modified more than once by that body and which may be modified further if Congress is sufficiently urged. The contract that he may have signed was not really a free undertaking, but one that he, singly, could not well have kept out of. He believes also that the nation never intended to place upon him a burden greater than his ability to bear; and actual practice shows that his land, being located far from markets and being farmed inefficiently, does not produce enough to enable him to bear the burden conveniently on top of his other debts. So, believing that the government can better afford to lose the money than he can, he is inclined to welcome cancellation of his government debt, and he forms organizations to ask as a preliminary for forty-year extension or some equivalent postponement of payment. More correctly stated, his office-holding local representatives do this, not the farmer himself.

Another point bears on the same bit of psychology. Various people have circulated the idea that the whole reclamation business was a money-losing affair from the start and was known to be such. Perhaps some soft-headed government representatives have at times preached doctrines that helped build up this impression; but most of it is due to the efforts of out-and-out agitators. Such agitators say, for example, that interest payment was remitted in the original Reclamation Act because it was known that irrigation was an unprofitable adventure; that all the good projects were developed by private capital, and even most of these

are not able to pay interest on the construction money; and that the government, in return for its loss of interest, gains tremendous amounts of income in taxing the wealth which it creates. By such ingenious bits of reasoning, these people try to yoke together in the general Western consciousness (1) the belief that reclamation cannot pay interest and perhaps not more than a small fraction of the principal, because it is unprofitable; and (2) the conviction that the nation should hand out great additional sums for further construction, because reclamation is profitable. It is going to be difficult to graft these views upon the thought of the country generally, or to get wide support for the development policies which they suggest.

But this is only another case of how the agitators have hurt reclamation. The reclamation farmer's financial credit has already been impaired by agitators, as expressed very definitely by Land Bank officials, and now the same agitators are creating doubt of the wisdom of doing more reclamation. Some day the farmers are going to wake up to how ill they have been served by the agitators.

The Pork Barrel—Following another line of thought, many men in the arid states feel that it is time the government did something handsome for them, after having lavished federal funds on rivers and harbors to the benefit of Eastern communities for these many years. Doesn't Congress take large sums of money out of the public treasury to benefit New York and Philadelphia by building them harbors and dredging channels? Doesn't it subsidize the Ohio River cities by canalizing the river at tremendous cost, and the farmers of the Mississippi River bottoms by leveeing the banks? Well, then, with equal justice the Western states may ask for government expenditures for the public good! And this means Treasury money, not Reclamation Fund money, because that belongs to the West, not to the United States, having been raised from Western lands and duly consecrated to the West by Congress in the Reclamation Act.

It needs no special imagination to picture the development of reclamation if the spirit of this school of thought comes to prevail. The long odorous pork-barrel system when extended to irrigation and drainage would furnish new and interesting possibilities. Senate votes for power grants on the Colorado might be traded in legitimate legislative manner for cessation of a filibuster on a deficiency appropriation for the Columbia Basin work (assuming that project to have been started by then).

State Apportionment—Definite convictions are entertained in most parts of the West concerning claims of the several states to reclamation money. The provision of the Reclamation Act which requires money to be expended according to geography rather than efficiency is partly responsible, no doubt. But even aside from this there is enough local rivalry, or jealousy, to keep these convictions alive. Their importance lies in the fact that such matters as water supply, soil, topography and settlement make reclamation difficult enough, without the intermixture of ward politics. The general citizen presumably believes that, if national expenditure for irrigation should rest on the basic consideration of efficient use of the money, the most productive and profitable projects should be undertaken. The believer in state apportionment may grant the premise but he denies the conclusion.

Alum Shortens Drying Period of Imhoff Tank Sludge

Laboratory and Operating Tests Lead to Adoption of Alum at Joint Sewage-Works of Plainfield, N. J.

Paper No. 130 of the Journal Series, New Jersey Agricultural Experiment Stations and New Jersey State Department of Health, Substation, Sewage Investigations, by Willem Rudolfs, John R. Downes and F. Leslie Campbell, respectively, Chief, Sewage Investigations, New Brunswick, N. J.; Superintendent, Plainfield Joint Sewage-Works and Member Research Committee, New Jersey Sewage Works Association, Green Brook Park, Bound Brook, N. J.; and Research Chemist, Sewage Investigations.

LABORATORY experiments on the effect of certain chemicals upon the rate of suction filtration of ripe Imhoff sludge made by Van der Meulen and Smith showed that aluminum sulphate gave the best results and suggested the addition of alum to the sludge to increase the rate of gravity filtration and evaporation on sludge-drying beds. (See *Jour. Ind. Eng. Chem.*, XV, 281, 1923.) The experiments were carried out at the Plainfield, N. J., joint sewage-works. Some of the drying beds used were located about 60 yd. from the Imhoff tanks. The sludge flows from the tanks along a trough into a mixing pit and is then pumped out upon the beds.

Van der Meulen and Smith used 6.7 lb. of aluminum sulphate per cubic yard of sludge. We used from 2.7 to 3.5 lb. per cubic yard. For gravity filtration it is desirable to have a quickly formed porous mat of gas-permeated solids floating on clear liquid, and it is this condition that we strove to approach in our work.

Investigators have stated that rapid and uniform mixture of the colloidal material with the elctrolyte is necessary to insure maximum flocculation. At first glance it seemed in our practical experience necessary to obtain a thorough mixture of the alum and sludge by stirring; accordingly, a motor-driven stirring apparatus was devised, consisting of the blades of a small boat propeller fastened to a long iron rod. This apparatus, put in operation at the Plainfield plant, showed at once that the stirring affected the appearance of the sludge materially. Upon examination it was found that the comparatively porous material—sludge aggregates interspaced by gas bubbles—became finely divided, leaving the finely dispersed material devoid of gas bubbles with a liquid film on top. It is desirable to have large flocs interspaced with fairly large gas bubbles in order that the liquid movement may be downward and thereby facilitate the draining off of the transparent liquid. The violent stirring of the propeller apparently beat out the CO_2 formed by the acid alum acting on the carbonates of the sludge, whereby the porosity of the solids was destroyed causing them to sink to the bottom. Further tests, in which the time of stirring ranged from one-half minute to ten minutes, were made but in no case were the results as satisfactory as those secured by gentle mixing in the following manner: The calculated amount of alum solution was siphoned into the sludge as it flowed slowly by in the sludge channel at a point where the stream of sludge turns at right angles to itself to pass through a shear gate to the bed. The right-angle turn folds the sludge over on itself, which motion, together with the drop into the bed, gives adequate mixing and the reaction is completed in quiescence so that the floc is not again broken up. Consequently the stirring apparatus was discarded in subsequent work. Tests were made in January, April and May of 1923 in the latter manner, and several treatments were made by the superintendent without checks to relieve the overload condition of his tanks.

The day after the January experiments were made a

heavy snowstorm accompanied by frost and resulting in a thick layer of snow, prevented us from making daily observations. The initial amount of sludge in the beds had shrunken considerably in the course of nine days. When the material was taken off the treated sludge consisted of a fluffy, spongy mass while the untreated sludge was stiff and hard.

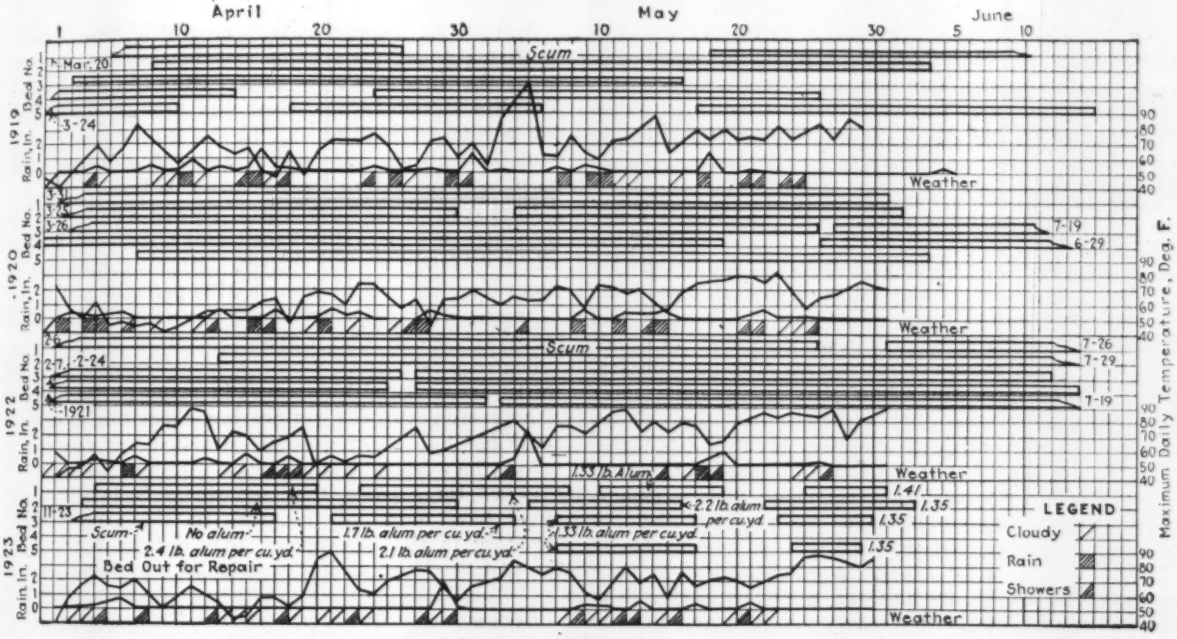
The amount of moisture present in the samples taken from the April experiments does not give a fair representation of the consistency of the drying sludge. The first few per cents of moisture are rapidly drained off but as drying proceeds the release of water becomes increasingly difficult and the sludge remains gelatinous for several days. This is very apparent when the moisture contents are compared with the time when the treated sludge was ready for forking.

make a few trials at their own plants to determine the exact amount of alum necessary for rapid dewatering.

The alum used was bought in large quantities at $1.75 per 100 lb., so the cost of treatment is well within practical limits. The total cost, for instance, is so small that variations over the range indicated in the chart would mean a variation between $28 and $51 a year for each m.g.d. of plant capacity.

In addition to the rapid drying, the sludge has a better texture for removal from the bed. Rain, even during the first few hours, has little effect on the drying as compared with untreated sludge.

There are no odors from the treated sludge. Local sludge gives some odor when untreated, during the first and second evenings after drawing. The treated sludge, when dry, is less voluminous than the untreated. The treated sludge



RATE OF DRYING OF IMHOFF TANK SLUDGE WITHOUT AND WITH ALUM ADDED TO SLUDGE

No alum used in 1919, 1920 and 1922. Alum used in 1923, at rates stated. Long bars indicate time one dose of sludge remained on bed to dry, each square being a day. Results for each of five beds shown separately. Rainfall and temperature plotted because of their relation to drying period; also, for each day, whether cloudy during daylight, rain or showers—a shower being a rainfall of less than 0.1 in. "Scum" indicates that bed in question was used to dry grease skimmed from tank instead of to dry sludge; results not comparable in such cases.

The May experiments were conducted with slightly different amounts of alum. Again the moisture content after ten days did not differ greatly but the appearance of the treated and untreated sludge was marked. Circumstances interfering with the securing of proper check experiments made it impracticable to carry on more controls. The superintendent, however, was so impressed with the advantages of this dewatering that he has applied the results of the experiments to the regular routine operation of the Plainfield sewage-works.

In the accompanying diagram the results obtained by drying alum-treated sludge during April, May and part of June, 1923, are compared with the results of drying untreated sludge during the same months of 1919, 1920 and 1922 (1921 is omitted because repairs to the concrete of the sludge channel in that year interefered with drying during this period). The treated sludge dried in approximately half the time required for untreated sludge. Alum to the amount of 3 lb. per cubic yard of sludge increased the acidity to pH 5.4 to 5.7, the original pH values being 7.4 to 7.6. Larger amounts of alum will give still shorter drying periods, but in view of the fact that with even the smallest amounts rapid drying is secured, we feel that no great advantage is gained by shortening the drying periods by one or two days at a much higher cost. It is apparent that the dose is not very critical within a wide range and operators could readily cracks within five hours. As with untreated sludge, best drying results are obtained by keeping the original thickness on the bed down to 9 or 10 inches.

The improved results of treatment since May 22 are due to a more thorough appreciation of the fact that the agitation should be kept down to a minimum and the dose applied as close to the drying bed as possible.

Laboratory work at the sewage substation, which will be extended and reported separately, later has furnished some explanation of the favorable results obtained by minimum agitation and has indicated that this minimum is so low that it has apparently escaped the notice of other observers. A second optimum condition of flocculation can be obtained, but only with an unwarranted excess of energy and alum.

Progress in Development of Non-Corrosive Steels

Great strides in the development of non-corrosive steels may be expected during the next few years in the opinion of Dr. G. K. Burgess, director of the Bureau of Standards. The waste represented by the corrosion of steel is so great that its prevention by the development of these special steels constitutes, in his opinion, one of the most important present-day trends in the steel industry.

Federal Land Reclamation: A National Problem

6. Difficulties and Complaints of the Farmer

The Sixth of a Series of Articles on the History and Performance of the Great Government Adventure in Irrigation of the Arid Lands of the West.

By H. H. BROOK
President, Elephant Butte Irrigation District, Las Cruces, N. M.

THE SUCCESS of the federal reclamation projects does not depend primarily upon perfect engineering, or upon rules of farming, or terms and regulations laid down in Washington. Success will depend upon the ability of the average settler to overcome the trials of creating wealth and making a home where nature never intended there should be one.

The building of a dam or a canal is a comparatively easy problem, rules for which can be found in scores of handbooks, but there is no formula for welding thousands of diverse human factors into a prosperous happy community.

Considering that the settler is the one who will pay the bills, his voice is relatively small and weak in the battle of words that is now taking place. Possibly there would be less complaint and more success if his advice and counsel were solicited. By training and habit he is not a speaker or a propagandist. He has, however, great powers of resistance. The great majority are united in the belief that they cannot meet payments twice what they expected when they signed their contracts, without disaster to at least three-fourths of the present settlers. Assuming that the doubled costs are perfectly legitimate and necessary, the settler should not be called upon to pay them in the same time he agreed to pay one-half as much. If it was not wrong for the Reclamation Service to have underestimated by one-half the work necessary, it is not wrong for the settler to ask for a longer time to pay this increased cost. The settlers as a whole do not want to avoid or repudiate payment.

Private and Federal Irrigation Contrasted—Business men and corporations weigh their possible earnings very cautiously before making large expenditures for fixed investments. Every promoter of private or corporate irrigation enterprises realizes every minute that the success of his project depends on the ability of the farmer to make enough money for the living of his family and the upbuilding of his farm. Consequently, every cent is expended *with a view to the ability of the farmer to pay.* The contrast of the reclamation project procedure is striking. Here the spending is done without any direct connection or relation between the earning capacity or the success of the enterprise as a whole. Well constructed engineering works do not insure success. The financial caution that animates every private enterprise is very remote.

While the Service contains a splendid body of loyal conscientious employees, and in most instances we are proud of their work, nevertheless it cannot be asserted that they are not fully conscious of this irresponsibility for the ultimate success of their work, and the mighty power of the government that protects them, and cloaks their mistakes. Generally speaking, they have no farm experience and no sympathetic understanding of the farmer's problems. Most of the criticism of their work comes from the farmers. Unless extreme precautions are taken a spirit of bitter enmity and disrespect for the farmers arises and influences their work. They are only human and the system of government work encourages these conditions.

A concrete example of the results of this lack of relation between the earning and the spending agencies is in the Rincon Valley of the Rio Grande project. The Rio Grande project cost has been announced as $90 per acre for all lands. In the Rincon Valley over $100 has already been spent, and $35 more per acre must be spent before the lands can be farmed, making a total cost of $135 per acre. This is $45 more than each acre will pay—the deficit being assessed against all other lands of the project. Much of the land in this valley will never be worth $135 per acre and it will be many, many years before any substantial part of the lands are worth that amount. It is a long narrow valley requiring many expensive river crossings and the works are menaced by arroyos in many places. There is no reason why the engineering difficulties and costs could not have been as well estimated ten years ago, before the work started, as today. With advance knowledge of these costs, the landowners certainly would never have approved the work on the present plan. Trusting in the government, they did not know what the cost would be until it was too late to stop.

Reclamation Service Secretive—This cause of ill feeling is further aggravated by a lack of frankness and free exchange of information between the Service and the farmer. Due perhaps to much unjust criticism in the past the Service has become pretty much of a close corporation. The system of accounting is not such as inspires any degree of confidence. Unnecessarily intricate and confusing, the farmer looks upon it as an instrument for his undoing. In general the farmer is only given such information as is considered good for him. Of course, any information specifically called for is always furnished but only so much and no more. Very often information is gathered at the farmer's expense for the specific purpose of refuting and bringing confusion upon him when he attempts to complain. Rightly or wrongly the farmer very soon reaches the conclusion that the power and resources of the department are leagued against him. There is not, as a general rule, that friendly feeling of co-operation, good will and sincere desire to help, that should rightly prevail between parties whose interests should be mutual, if not paternal.

These conditions—avoiding responsibility, lack of candor and secretiveness—which have caused so much trouble, have been relieved on the Rio Grande project in recent years by a policy of greater co-operation and mutual understanding between the project manager and the official representatives of the farmers. The project manager refers all major policies and construction fea-

tures to the farmer's representatives, who are allowed to discuss and pass upon them, thus dividing responsibility for the success or failure of this particular matter. In earlier days, and even yet on many projects, the farmers are allowed no voice in the manner and policy of the work after the contract is signed. Often the farmer's advice is found valuable, his experience prevents mistakes, and his backing changes to approval what would otherwise be resented and condemned. Long experience with project farmers proves that the majority are generally fair, reasonable and sound. If taken into confidence by a studied policy of consistent project publicity, telling them fully the whys, wherefores and costs of each thing, admitting the mistakes and calling attention to successes in a simple, clear, frank and open manner, they would be found on the right side in practically every instance. The theory that silence reduces the amount of trouble stirred up is a fallacy. The farmer is an extremely suspicious individual but a staunch friend when once his confidence is won.

Farmers Not Incompetent—From articles and discussions of various reclamation enthusiasts, concurred in to considerable extent by the bureau heads, the average person would gather the impression that the greatest part of the financial difficulties on reclamation projects was due to *incompetent* settlers. Not only is this fundamentally untrue but it is such a specious line of reasoning, so constantly reiterated, and so harmful to the splendid work of reclamation that something must be said about it from the farmer's viewpoint. Our reclamation theorist, with naïve ingenuousness, loudly proclaims that the reason his theory hasn't worked is, forsooth, because the settler isn't competent. Wonderfully convenient idea, and so simple and plausible! But have any facts been produced to prove it? None that we have ever seen in many years on the projects.

The accepted axiom that it has taken three failures to make one success on the reclamation projects does not *ipso facto* prove that the three failures were incompetents. It might as easily prove, what nearly all the actual settlers contend, that the building of a modern community out of the desert in defiance of nature, and the payment in twenty years of vast irrigation works beyond the scope of private capital, is a burden beyond the ability of the average good farmer to carry.

It is true that there are incompetents and drifters on all our projects, but in no greater proportion than in any other western occupation. Even the Reclamation Service has its incompetents, and probably in as great proportion. As a class, the men that go upon our western projects are not incompetent. They are of the same pioneer stock that has made our western country great—the class that in a few decades has built the country of which we are wont to boast.

It is urged that the settlers on federal reclamation projects be selected for their fitness. If the law of averages must be eliminated, is it not a confession that the terms are too severe? Are we to have an example of the "law of the survival of the fittest" administered by some bureaucrat instead of by nature?

Drainage Losses—A dilatory policy with regard to drainage has been the source of an inconceivable amount of financial difficulty on many of the projects. Losses from seepage were allowed to occur, often aggregating more than the total cost of the project. Many farmers lost their holdings and the savings of a lifetime. All of them have been so crippled financially that it will take many years of fair returns to recover any large ability to pay. The excuse offered by the Reclamation Service is that the farmers would not vote to approve the cost of drainage. This is true, but, while on the face it seems a valid excuse, upon analysis it is found superficial and unsound.

It cannot be denied that the engineers of the Service were charged with all the responsibility of laying out and estimating the needs of a project and its cost. Theirs was the technical knowledge, and their recommendations were final. The impression was given that a fatherly government would call in its wisest men, devise the best system and the farmer need have no fear or suspicion. The farmer was allowed no voice in planning and, admitting his ignorance, relied upon the federal engineers' assurance of an adequate system and a properly estimated cost. Very soon it became apparent that the irrigation works were going to exceed the estimated cost. The farmer saw evidences of mistakes, experimentation, and what appeared to be lavishness, that shook his faith and confidence. Few of the farmers realized the danger of seepage, and before this danger was fully apparent he was asked to sign a new contract for a greatly increased cost to cover drainage. True to every natural and human instinct, and not realizing perhaps that he was trapped, he rebelled and refused to sign.

In the first place, there is no possible excuse for the government engineers not knowing the necessity for, and providing for, drainage in the original estimates. It was discussed but no allowance was made, because (it is weakly contended) it could not be determined whether it would be needed or not. On the Rio Grande project, at least, the noted English engineer, Sir William Willcox, warned the government of its error in unmistakable terms before the project was even begun. In the second place, having for one reason or another overlooked this obvious duty and responsibility, a more aggressive policy should have been pursued to remedy the pending tragedy. What was actually done was to sit back and say in effect, "Sign on our terms or drown, your sins are on your own heads." The Service has often exercised arbitrary power in less important matters and having, as they contended, a contract for the payment of the actual cost no matter what it might be, why couldn't they have arbitrarily insisted upon drainage?

Furthermore, realizing full well the pending tragedy, and if the signing of a new contract was an absolute necessity, what was there to prevent an intensive publicity and educational campaign early in the development? The government could well have afforded to spend thousands of dollars in such educational work. A few formal warnings were issued, but it remained for the farmers to organize such an educational campaign after the damage was done.

The Government Benefits—As to benefits: bearing in mind that no agricultural development is possible in the arid states without irrigation, and that such development is vital to public progress, which is recognized in the extraordinary powers granted to irrigation districts, is it not clear that the chief and primary beneficiaries of irrigation development are the nation, state, county and cities? These institutions are perpetual, the individual is transitory. The individual

hopes to make a profit, and occasionally does, but the nation, state, county and city inevitably profit in perpetuity both on the improvements and production. The nation's meat supply, the vast cattle and sheep breeding ranges, are protected from the scourge of periodic drouths. The cities and towns in most instances in the arid section are largely dependent for their prosperity upon the production of the irrigated lands.

The original plan of the Reclamation Act was to finance those projects which are beyond the scope of private interest-bearing capital. The avowed purpose was the establishment of contented rural homes, but this idea is first predicated upon national welfare in the recognized advantages of a home-owning agrarian population and the increase of taxable wealth.

Federal aid alone, as given by the reclamation law, does not accomplish this aim. It requires the extremely hazardous co-operation of some venturesome individual with an abundance of brains, money and energy. It is an axiom of the irrigated West that every success is built upon the cumulated efforts of three failures. To successfully create a prosperous farm from the desert, even with federal aid, is a vastly more hazardous job and requires a higher and more able type of citizen than it took to develop the free homestead lands of the Middle West.

Pioneering Unprofitable—The up-building of the country, as recited, is a necessary adjunct to profitable farming and must be done during or before the farmer can be expected to pay for irrigation works. In the meantime, he must house, feed, clothe and educate himself, his wife and children. Does it seem reasonable or feasible? Can anyone assert that the pioneer farmer has even an infinitesimal chance of profiting in proportion to the government? The farmer takes all the risk and experience shows that a very large majority of the pioneers lose. Except for gross mistakes, the government takes no risk and can't lose.

Since the benefits of increasing farm homes and national wealth are unquestionable, and the works are not private, but public, to be enjoyed by the nation for all time, what sound reason is there for not extending the time or repayment to a point where the purpose of contented homes and increasing national wealth can be accomplished without a trail of discontent, hardships, failure and tragedy?

The conclusion should not be drawn from this article that reclamation is a failure—far from it. The development of our natural resources through reclamation is the best and most profitable investment the government has made or can make. Every dollar invested has already returned manyfold in national wealth. These facts need not be repeated.

The Reclamation Service has unquestionably been one of the best administered bureaus of the government with no taint of politics, graft or intentional wrong. Compared with the public management of our roads, schools, counties, municipalities and other corporate large scale irrigation systems, the Reclamation Service has done fully as well as, if not better than, the people would have done under their own management. In fact, it is vital in some instances to have an organization in charge that is not influenced in the least by local prejudices, habits or politics. This article attempts to give the farmer's close intimate views of some of the causes of the complaint and criticism arising on the projects

Protecting Highway Bridges From Colliding Vehicles

Destruction of Bridges by Collisions Becoming More Frequent—Skid Beams, High Curbs and Traffic Guides Advised

By E. F. Kelley

Senior Highway Bridge Engineer, Bureau of Public Roads, Washington, D. C.

IN LESS than two years *Engineering News-Record* has published accounts of the destruction of four steel truss bridges by motor vehicles which collided with the truss members. The last three of these accidents occurred within eight months. Doubtless other accidents of a similar nature have occurred which have not been reported in the technical press, and the writer knows of one such case in which the end post of a truss was wrecked by a truck, although the complete failure of the structure did not ensue.

The situation is grave, as has been pointed out editorially, and it promises to become more serious as time goes on. With ever-increasing speed and density of traffic, such accidents will doubtless occur in ever-increasing number. Therefore the problem of the adequate protection of bridge structures, particularly steel trusses, from injury or total destruction by motor vehicles merits the careful consideration of every engineer interested in the construction or maintenance of highway bridges. The problem is not a simple one, involving as it does not only development of suitable structural details but also the important item of additional expense.

DAMAGED HIP VERTICAL
Showing absence of adequate protection.

From the reports of accidents it is evident that not only the end posts but also the entire web system must be afforded protection. End posts may be adequately protected from vehicles approaching the bridge by massive masonry posts, but protection of either end posts or web system from vehicles on the structure or leaving it is not so simple.

Skid Beams—In a letter published in *Engineering News-Record* of Jan. 18, 1923, p. 131, is found the suggestion that the trusses be protected by skid-beams such as are in use on railway bridges. Undoubtedly this would be a step in the right direction. Such members, if of sufficient strength and properly placed, would give much better insurance against accident than is now usually afforded. However, their appearance and cost might cause some objection to their use, and they would also involve some rather difficult details.

For the most effective protection, the beam supports should be independent of the truss members. Several lines would be necessary, for the truss must be protected not only from fenders and hubs but also from overhanging bodies, and this would necessitate that the

top beams be placed at some considerable distance above the bridge floor, which might mar the appearance of the structure. Also the beams would necessarily be of greater strength in proportion to the weight of the traffic units than in the case of railway bridges; for, on a highway bridge wide enough for two lines of traffic it is entirely possible that a vehicle may strike the rail almost head-on. The cost of providing steel rails that would stop a charging truck would seem to be prohibitive.

Protection by Curbs—The suggestion that the necessary protection be afforded by adequate curbs seems to offer the most satisfactory solution which has been advanced. But here again we are confronted with questions of appearance and cost, as well as with the fact that the necessary curb construction will scarcely be feasible on bridges not floored with concrete.

Curbs which will stop a car must be at least as high as the center of the wheels. This means a minimum curb height of 15 in. with 18, 20 and even 24 in. required for the larger vehicles; a curb 18 to 20 in. high will provide for the greater portion of traffic. From the standpoint of cost the curb width, or the distance from the face of curb to the clearance line of truss, is more important than is the curb height. The lack of standardization of truck bodies leads to a great variation in the amount of overhang, which may be as much as 30 in., possibly more in extreme cases. However, it is not practical, nor is it necessary, to provide for such extreme conditions. Based on information supplied by truck manufacturers, the conclusion is reached that a minimum distance of 12 in. from face of curb to clearance line of truss will be sufficient to provide for at least 95 per cent of motor vehicle traffic. This conclusion is given some added weight by the regulatory state laws governing widths of truck bodies, although too great dependence cannot be placed on legal requirements, as frequently they are not enforced and in any case they may be revised or repealed at any time.

Such curb heights as are suggested here may be a shock to our conventional ideas of appearance. Again, the extra curb width will add to the cost of the structure by requiring that the trusses be placed farther apart to give the same width of roadway between curbs.

It is to be noted that by flaring the ends of such curbs and extending them out onto the approach fill or pavement at the end of the bridge, the end posts of the bridge may be protected from approaching vehicles.

Traffic Guides—In addition to the positive protection of the structure by mechanical means much may be accomplished by means of traffic guides, especially those which are effective at night. Marking traffic lanes by lines painted on the roadway surface has proven most effective on pavements, and it should be equally effective on bridges. Painting the handrails a light color, which is practiced in some localities, also adds to the insurance against collision.

Public Safety—Of equal or greater importance than the protection of the structure from injury or destruction is the protection of the traveling public. For a number of years the Iowa Highway Commission has kept a record of accidents of all kinds which occur on the highways of the state. The commission's *Service Bulletin* reports that 58 automobiles went through bridge railings in 1921, while 64 similar accidents occurred in 1922, with a total of 130 persons injured in the two years. This is the record for one state of the forty-eight. Does not the situation demand a remedy? On through truss bridges the protection which will safeguard the structure will also safeguard traffic. On other structures substantial curbs or railings are necessary.

In some states it is the practice to insure an adequate width of approach fill at the end of the bridge by building flaring abutment wing walls with horizontal tops for a portion of their length. On this horizontal portion is constructed a substantial rail of concrete or other material in keeping with the structure, and the fill is maintained at roadway level to the end of the rail. The wing rail and the added width of approach fill increase the safety of vehicles by affording actual protection from accident, while the rail increases the visibility of the bridge and gives it an improved and finished appearance.

The above discussion is presented to emphasize the facts and opinions which have already been published, in the hope of arousing engineers to the need for a most serious consideration of the situation, to the end that our bridge investment may be safeguarded.

TWO TYPICAL BRIDGE ACCIDENTS DUE TO MOTOR VEHICLES NOT HOLDING THE ROAD

At left: Wreck of bridge over Little Patuxent River near Savage, Md., two years ago; in spite of signs warning that the roadway was too narrow for two vehicles, a passenger car and a truck tried to cross at the same time, with the result that the web system of the trusses was knocked out.

At right: A recent accident near Alexandria, Va. The car was going at high speed, the approach to the bridge is a sharp curve, and the car failed to make the curve. As the structure is of deck type, the car merely went overside; a through truss bridge would have been wrecked.

Present-Day Street and Pavement Practice for Cities

A.S.M.I. Discussion Recommends Increase of Radius and Widening of Curves—New Penetration Requirements

Abstract of Report of Committee on Street and Highway Design, presented at convention of the American Society of Municipal Improvements, November, 1923: E. R. Conant, chairman, P. L. Brockway, S. Q. Cannon, H. E. Barnes; together with papers on details of street and highway design.

Report of Committee on Street and Highway Design

THAT municipal and other engineers are recognizing the advantage of long radius corners is shown by the replies received to our questionnaire sent to many cities. Hartford, Conn., reports changing from 6 ft. to 12 and 15 ft. and states that a great improvement is noticeable with this change. Waterloo, Iowa, which formerly used 10 ft., changed a few years ago to 15 ft., and this year changed some dozen street intersections to 30 ft. Toronto, Canada, had originally 12 ft., then changed to 18 ft. and now has adopted 25 ft. Los Angeles reports that it uses a radius at curb returns equal to the width between the curb and property line, except where the distance on both streets is 15 ft. or more. In such cases the radius is made 5 ft. greater than this distance.

At Muskogee, Okla., the narrower streets are given the greater radii: 24- to 30-ft. streets have radii at corners of 12 to 15 ft., while for 30 ft. or over, a 10-ft. radius is used. Pawtucket, R. I., is increasing the radius from 15 to 25 ft. and Davenport, Iowa, 10 to 15 ft., Cheyenne, Wyo., new pavements are 18 ft. Other cities report adopting radii of from 10 to 225 ft.

Elimination of Catch Basins—There is a decided tendency towards eliminating catch basins and connecting the inlets direct to sewers or storm-water conduits and especially is this done where there are adequate-sized storm sewers with good slopes.

An unusual method of disposing of storm-water drainage is reported from Phoenix, Ariz. No storm-water sewers have been constructed. Walls of 6 ft. internal diameter are sunk to water bearing sand, usually 20 and sometimes 30 ft. below the surface. Brick is used for lining, laid open 6 ft. down from the top. With proper inlets into the wells, it is reported that satisfactory results are attained, the water-bearing sand taking away the discharge. Each well serves about 45,000 sq.ft.

Special Curb and Gutter Construction—An innovation in curb cross-section is being introduced which appears practical and beneficial. We all know that automobile and truck tires are often injured by grinding against the vertical rough stone curb. A few cities are adopting a curb with a batter on the gutter side and again this batter is sometimes merged with the gutter and the gutter and curb formed with a curved face. Jacksonville, Fla.; Shreveport, La.; Salt Lake City; Phoenix, Ariz.; Sacramento and Hartford are introducing this method to a greater or less extent. Quite a number of cities having bituminous pavements are introducing a gutter 4½ to 6 ft. wide, built of concrete brick or hard surface, which will not be affected by gasoline or oil drippings from automobiles or trucks. Boisé, Idaho; Muskogee, Okla.; Sacramento and St. Louis report this improvement.

Changes in Penetration Pavement Construction—The penetration limits for asphalt used in asphaltic pavements are being decidedly reduced, according to information received from a large number of cities. Also quite a few report using additional amount of dust. The changes bring about a harder mixture preventing pushing under traffic.

Information received from many engineers shows that they are increasing the concrete base thickness and, in some instances, increasing the thickness of the wearing surface. Peoria, Wichita, Davenport, Oak Park, St. Louis, Tulsa, Sioux City, Pontiac, Oklahoma City and New Orleans report increase of depth of base of about 1 in. The average adopted for heavy traffic is from 7 to 9 in.; medium, 8 to 7 in.; light, 5 to 6 inches.

Cost-Plus—George A. Carpenter, city engineer of Pawtucket, R. I., reports a rather unusual method of making payment, under the cost-plus basis. The paving done amounts to about $300,000 per year and is contracted for and paid on the cost-plus basis. Before the contract is made, a fair estimate of the cost per square yard is agreed upon and the contractor is to be paid the actual cost, plus 15 per cent upon the estimated cost, if the final cost does not exceed this sum. If the final cost does exceed this sum, he is to pay all such excess cost, until his percentage of profit is reduced to 10 per cent, as figured upon the estimated cost per square yard. Beyond this point of reduction, the city will pay the extra cost. Should the contractor succeed in laying this pavement for less than the estimated cost, he will receive 15 per cent upon such estimated cost and one-half of the saving he will have made to the city.

* * *

Curve Widening

By G. A. Crayton
Springfield, Ill.

HIGHWAY curves, if sufficiently sharp, should be widened. There appears to be very little agreement in the practice of the several states in this country; which is shown graphically in Fig. 1. One state will widen a maximum of 8 ft. and others no more than 3 ft. The greatest

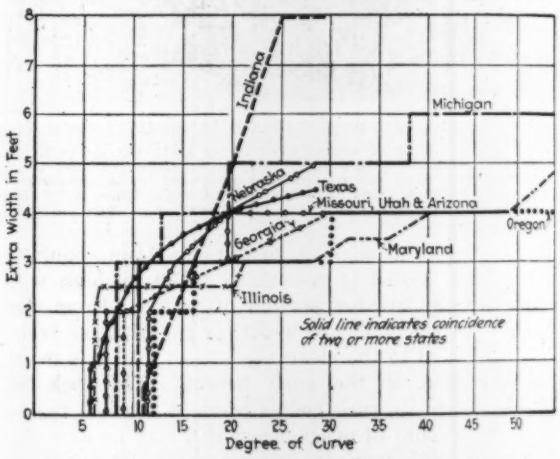


FIG. 1—HIGHWAY CURVE WIDENING PRACTICE

variation of opinion seems to be on curves of from 6 to 12 deg. It is the purpose of this paper to develop a method of widening that will be sufficiently flexible to meet all reasonable conditions.

It is a well-known fact that, when traversing a curve, the rear wheels of a vehicle will track inside of the leading wheels. Except in case of trailers built to track, each pair of wheels in a train will continue to track inside of those ahead of them. This, in the judgment of the writer, is the only logical reason for the practice of widening curves.

To develop a method for determining the necessary amount, it is first essential to determine the kind, general dimensions and construction of the motor truck and its trailers. As a rule, the longer trains will use "tracking" trailers. Our formula should, however, take account of the worst possible case, that of a motor truck of long wheel-base drawing a train of ordinary farm wagons. To make a few assumptions: (1) that there will be no side slip of the wheels; (2) that the path described by each pair of wheels

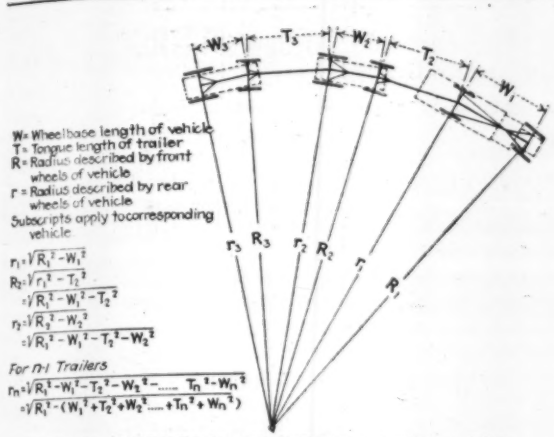


FIG. 2—CONDITIONS AFFECTING FORMULA FOR WIDENING CURVES

is an arc of a circle, after equilibrium has been established; (3) that the center of the curve will be the common center of all paths; (4) that the front axle of each trailer is at right angles to its tongue; (5) that each rear axle is at right angles to its reach. While all of these are not strictly true, it is believed that the approximation is sufficiently accurate. The conditions as outlined will result in the formula as shown in Fig. 2.

To secure some specific figures, assume a truck with a wheel-base of 144 in. and from one to five trailers, each being an ordinary farm wagon having a wheel-base of 7 ft. and a tongue length of 13 ft. Working out values on this basis, values of difference of track are obtained as shown in Fig. 3.

At last year's convention of this society, it was recommended by the Sub-Committee on Sidewalks and Street Design that in general the width of the roadway should be based upon a certain number of lanes of traffic and that a definite width should be allowed for each base. We will apply this principle to the case in hand, and assume that track difference constitutes the reason for widening. Highways of sufficient importance to warrant widening should be designed for a minimum of two traffic lanes. Each of these lanes should have applied the track difference as its extra width or a two-lane road should be widened double the tracking difference.

A better method of application is on a percentage basis.

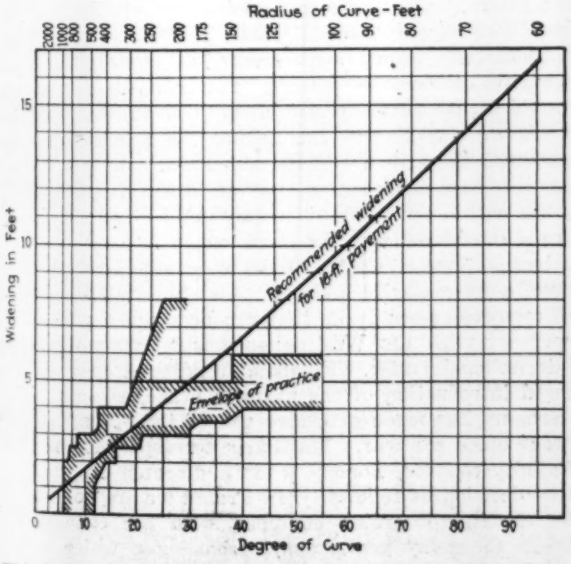


FIG. 3—RECOMMENDED WIDENING FOR 18-FT. PAVEMENT COMPARED WITH PRACTICE SHOWN IN FIG. 1

The usual over-all width of a vehicle is 5½ ft., which requires in usual practice a 9-ft. traffic lane; then if a given set of conditions of a curve and vehicles cause a track difference of 1 ft., the "effective" width of the vehicle and train together is 6½ ft., and the width necessary for its traffic lane will be expressed by $(9 \times 6.5) \div 5.5$, in feet, or since two traffic lanes are under consideration, the total width of the curve would be $(2 \times 9 \times 6.5) \div 5.5$, or 21.27 ft., in which case the widening is 3.27 ft. This allows the same proportion of extra width in the strip between the vehicles as required by the vehicles themselves.

That we may compare the results by this method with current practice, Fig. 3 shows by curve the extra width required on the basis of a truck with two trailers on an 18-ft. pavement, the shaded area representing the "envelope" of practice shown in Fig. 1. It will be noted that in general the state requires more width than necessary on flat curves and less than required on the sharp ones. Or, expressed differently, the recommended curve is nearly a straight line, while nearly all of the practice curves are decidedly concave downward.

* * *

Some Details in Street Design

BY P. L. BROCKWAY
Wichita, Kan.

SOME engineers have thought that it should be possible to retain the very excellent qualities of the standard sheet asphalt wearing surface, and yet increase its resistance to internal flow, by adding larger, angular aggregate up to material passing a ½-in. screen without any other modification of the mixture. A surface was constructed along these lines four years ago, on a brick surface which had been practically destroyed by the concentrated heavy traffic leading to two ice and cold storage plants, a large planing mill and a freight depot. Asphaltic cement having a penetration of about 45 was used. It had to be made specially for this contract at that time but it is now a standard product of the company from which it was purchased. There was used about half as much material over the ½-in. and through the ⅜-in. screen as would ordinarily be specified in the fine aggregate asphaltic concrete mixtures. Street temperatures ranging from about 0 to 125 deg. F. have been observed with standardized thermomoters many times, the maximum being 137 deg.

Traffic counts indicate an average of 600 trucks daily or about 200 tons per foot width. In addition heavy reconstruction of some of the plants has caused some very heavy loads of machinery to pass over it and heavy, vibrating construction machinery to stand in one place for weeks at a time. The pavement marks up some in extreme hot weather but has not yet developed any waves or general unevenness of surface. The same mixture has since been used on several other of our heavier traffic business streets having traffic counts up to 10,000 vehicles per day and only one serious wave was developed. That where a 4-in. wearing surface had been laid to even up over the old pavement.

Another point in the construction of soft top pavement which is more pertinent than formerly is the degree of roughness of the base course on which the surface is laid. Many old pavements which were laid with rock aggregate so coarse that it was practically impossible to get an even contour, to say nothing of a smooth surface, are holding their own pretty well even under the punishment of greatly increased traffic. Other base laid with greater care in later years, and especially base laid without coarse aggregate having fairly smooth surface texture, has not fared so well. Examination shows that spots which give the greatest trouble from shoving of the wearing surface are above unusually smooth places on the concrete base. There was, therefore, developed a plan of artificially roughening the surface by marking across the base at intervals of about 18 in. by striking it with an inch rope when the concrete is still soft enough to be readily cut by the rough rope. The marks are made about ½-in. deep. This method has not been in use long enough to prove its merit but there is no ques-

tion that roughening of some kind will be an advantage.

A very troublesome kind of traffic to handle in cities in the agricultural territory is tractors loaded up to 15 tons and having deep lugs or cleats on the driving wheels. Concrete, brick and standard asphalt surfaces all fail alike under such abuse. Many places cannot afford granite blocks. Most cities, of course, try to concentrate this traffic on one or two streets.

It had been surfaced with penetration macadam some years earlier and, while it was not worn through, the surface was very badly pitted. The remaining patches of the surface were loosened and spread over the well compacted sand fill macadam. The new wearing surface was what might be called a plant mixed macadam. It was composed of limestone from 1 in. down, with all the dust and screenings retained. Screen analysis showed that it contained from 5 to 8 per cent of 200-mesh clean limestone dust. The specifications required that sufficient asphaltic cement having a penetration of 90 to 100 be added to thoroughly coat all particles and then about 0.5 per cent more be used and that it be mixed hot in a standard pug mixer. About 6½ per cent asphalt concrete was used rolled hot to a thickness of about 2 in. The texture of the rolled surface was quite porous because of the excess of large aggregate. On this was placed a squeegee coat of the same hot mix, running about 4 lb. per square yard. Hot, coarse sand was immediately spread over the whole surface and thoroughly rolled.

The objective was to obtain a mixture with an excess of plastic asphalt concrete which would rebond the surface material as often as it was displaced by the chopping action of tractor lugs. Over 20 lb. per yard was used. This surface has now been in use two years and, while there was some dissatisfaction the first year because some of the material would occasionally stick to an especially heavy wheel, it has proven so satisfactory the second season and is holding its contour and surface so well, that the tractor operators recently held an indignation meeting because the same material was not used on a main thoroughfare which they must occasionally use.

Another detail in pavement design which has proven very successful is the use of creosoted wood of 2-in. commercial thickness set with the grain vertical in transverse contraction or expansion joints in concrete pavement. Such joints have been in use twelve years without a single failure without costing anything for maintenance and without the objectionable lump which so often develops.

* * *

Modern Construction of Brick Pavements

By Will P. Blair
Vice-President, National Paving Brick Manufacturers' Association, Cleveland, Ohio

THE MANUFACTURERS of vitrified brick, through the Western Paving Brick Manufacturers' Association, now advocate an asphalt in place of the portland cement filler for joints previously urged. This filler is a certain refined asphalt, which has the quality of maintaining its place in the brick joints, under extreme high temperature and does not become rigid and fragile under the influences of low temperature. The new filler affords such flexibility that the forces operating with an upward thrust against the brick surface [due to expansion of subgrade due to saturation or other causes] have little injurious effect. This filler protects the edges of the brick equally as well as the cement filler.

Important details subject to neglect and oversight are: (1) The stabilization of the subgrade by reducing to a minimum the possible moisture content, (2) the smoothness of the artificial base, (3) the uniform compression of the sand bed upon which the brick are placed. Unless compressed, the brick wearing surface will ultimately conform to any unevenness of the base surface. This requirement can only be accomplished by using a hand roller and filling the depressions noticed after each rolling. Three to four repetitions are necessary to accomplish the desired result.

Forecast of Railroad Situation in 1933

IN ORDER to check its estimates of the probable traffic increase in the next ten years and also to establish a practical basis for estimating the increase in railway facilities and the additional investment in railroads that would be needed in order to handle the increased business, the U. S. Chamber of Commerce Committee on Governmental Relations to Railroad Transportation sent a questionnaire to each of the Class 1 railroads asking them to check its estimates of the increase in traffic, and to state what physical facilities they would require to handle this new business. Sixty-two railway companies operating 166,810 miles of line, or 64.6 per cent of the total mileage in the United States, sent in replies which agree substantially with the committee's estimate that there will be an increase in passenger traffic of about 25 per cent and that there will be an increase of 33⅓ per cent in the ton-miles of freight. The results of these computations indicate that the railways of the country as a whole, in order to handle the increased traffic, will need to make the following increases in their physical facilities within the next ten years:

	Miles
First main track	5,950
Other main track	11,400
Yard and sidetracks	21,000
Total, all tracks	38,350
Locomotives	13,200
Freight cars	725,000
Passenger cars	12,300

Using present prices as a basis for estimating the cost of this new work and additional equipment, the capital requirements will be as follows:

Additions	$5,339,874,000
Improvements	2,533,103,000
	$7,872,977,000

This figure takes no account of the capital required for grade crossing elimination, automatic train control, and other safety provisions which will be, or already are, mandatory.

Westinghouse Brake for European Railways

The adoption of the Westinghouse brake by the railways of continental Europe has been recommended by the International Railway Commission (see *Engineering News-Record*, May 17, 1923, p. 871) and also by a commission which met recently at Paris as representative of the allied powers. The treaty of Versailles provided that Germany should equip its railway rolling stock with appliances facilitating the interchange of cars with the railways of the allied countries and these powers were to select a type of uniform continuous brake within ten years. The only other compressed-air brake considered was the Bozic which is used to some extent in Serbia. Choice of the Westinghouse does not involve its exclusive adoption, since any other system of compressed-air brake that can be coupled with and operated with the Westinghouse will be admitted in international traffic. Financial conditions may delay rapid introduction of the uniform brake, especially as Germany has made extensive use of the Kunze-Knorr brake since the war. The Paris correspondent of the *Railway Gazette*, London, ends a dispatch on the recent decision as follows: "In France we are not likely to see freight trains equipped with the continuous brake for many years, apart from those which were handed over by the American army and which have been the best advertisement of the Westinghouse brake that could have been desired."

South and West Unite to Promote Extension of Reclamation

Forestry, Reclamation and Home-Making Conference at New Orleans Discusses Reclamation Problems of the South

Engineering News-Record Staff Report

TWO HUNDRED men, largely from the South and Southwest, but with a goodly number from Utah, Idaho, Arizona, and California, met at New Orleans, Nov. 19-22 in answer to a call made by C. S. Ucker of Savannah, Ga., A. G. T. Moore and Walter Parker of New Orleans, F. H. Newell of Washington and others, to attend a Forestry, Reclamation and Home-Making Conference, under the auspices of the Southern Pine Association, the Florida and Mississippi Development Board and the New Orleans Association of Commerce.

Perhaps the most notable feature of the meeting was the spirit of co-operation shown between the South and the West, as evidenced by the remarks on the convention floor, corridor talks and a telegraphic exchange of resolutions between the Western Reclamation Association and the conference, all bearing on extension of reclamation to include cut-over, swamp and overflowed lands, chiefly in the South. Land colonization, the problems of the settlers, the revision of the present Reclamation Act and a variety of other topics were considered. A number of resolutions on future reclamation policy were adopted.

Permanent Organization—The conference appointed an executive committee with power to formulate a plan for permanent organization. Among its members are: Chairman, Clement S. Ucker, president, Southern Settlement and Development Organization; F. H. Newell, consulting engineer, U. S. Reclamation Service; and U. S. Senator William B. Bankhead of Alabama. It was voted to request the delegates to hold conferences in each state, Virginia to Texas. It was announced that the committee would take steps to form a Southern Reclamation Association and that the permanent organization would act as a clearing house for the association just named and others as well.

Co-operation Between West and South—All through the conference, stress was laid on co-operation between the West and South in furthering reclamation. Repeatedly it was asserted that the Reclamation Act of 1902 owed its passage to Southern votes, under the leadership of Senator Underwood and Congressman (now Senator) Bankhead of Alabama. This was attested to by men at the conference from both West and South, who said that it was the understanding, in 1902, that when the South called for federal aid in reclaiming swamp and cut-over lands the West would respond. Mr. Ucker of Savannah added that all the southern States, except the two Carolinas, Virginia and Georgia, had had public land and that such still exists in Florida, Alabama and Louisana, where federal land offices are maintained. As representing the viewpoint of a westerner, it may be noted that in an interview during the conference, Congressman Addison T. Smith, of Idaho, chairman of the House committee on Irrigation and author of the Smith-Fletcher and the Smith-McNary bills, stated that there is no reason why the South cannot benefit in the same way as the West through federal aid, *"to be repaid of course, by the communities assisted."* The swamp and marsh lands of the South he added, will be highly productive when placed under cultivation, and the South is entitled to assistance in solving this big problem.

Interest on Reclamation—The italicized quotation reflects on the desire in some Western quarters to get rid of the obligation to pay for the cost of irrigation works incurred by settlers when they took up land on the reclamation projects. The revolving fund which was to be formed by these payments has "stopped revolving," as Mr. Ucker said. Significant, also, in view of the absence of interest charges against Reclamation Service settlers was Senator Bankhead's statement that in the future no federal aid to reclamation ought to be given without interest charges to the beneficiary equal to what the government itself has to pay. George H. Maxwell and others also urged payment of interest on future reclamation loans.

Claims of the South — Speaking of the Western promises of 1902 to aid the South when called on, Col. Joseph Hyde Pratt, of North Carolina, said that only within the past two years has the South begun to be interested in reclamation, and that now this term needs a broader definition than that which has been understood in connection with the 1902 Reclamation Act. But aside from former promises, present-day conditions were urged in support of the southern claims. Thus, Senator Bankhead said that there are today ten acres of reclaimable land in South to one in the West, and that nowhere but in the South is there land available to meet the agricultural needs of the population a few decades hence.

Nation-Wide Policy Needed—A nation-wide reclamation policy, formulated by a well-rounded commission, was advocated by Col. Joseph Hyde Pratt of the North Carolina Geological and Economic Survey, Chapel Hill, N. C. Land classification according to adaptability for various purposes is needed. Lands subject to overflow that have been reclaimed are generally in use, due to their being located in settled communities. The case with swamp lands is different; it will take years to get them under cultivation. Of the idle worn-out lands, some should be planted to trees and some restored to cultivation. The cost of Western reclamation by irrigation has increased from $30 to $100 per acre. No $100 projects should be put through. It is no longer true, said Mr. Pratt, that the West affords cheap lands. That promise has shifted to the South. Two great aids to reclamation would be topographic maps and improved highways.

Co-ordination in Water Control—A plea for co-ordination of many efforts having to do with utilization of water and protection of land from the evil effects of water when uncontrolled was made by Walter Parker, secretary of the New Orleans Association of Commerce. This co-operation should include federal, state, county, city, and rural agencies, and particularly the many federal departments and bureaus that work as if unaware of the others having to do with water. The late Senator Newlands, who took great interest in the matter, said Mr. Parker, was nearly defeated at the time of his last election to office because it was urged against him that his interests were too broad and that he should devote himself to the needs of Nevada. In 1917, Senator Newlands secured the passage of his Waterways Commission Bill. In 1919, he having died

meanwhile, the bill was repealed. The bill was again introduced last year and will be re-introduced in the next congress. The Waterways Commission Act, provided for the sort of federal study that must precede the formation and execution of a broad policy of water utilization and control.

Home-Making and Citizen Development—Throughout the conference it was repeatedly urged that home-making opportunities for persons of moderate means should be provided.

Improved Reclamation Methods—George H. Maxwell, of California, long well known for his advocacy of western irrigation, addressed the conference on Western Methods as Applied to the Southern Conditions. He laid down five principles of future reclamation development; (1) Reclamation must accord with a national policy; (2) Federal loans must be repaid; (3) Interest must be paid on loans; (4) the federal government must not serve as collector of principal and interest; (5) reclamation projects must be set in motion by the formation of districts having the power to levy taxes, issue bonds and make contracts.

Cut-over Lands—The vast areas of cut-over lands in this country, said John H. Kirby, president, Southern Pine Association, must be reforested if at all by public funds. Timber is the best all-round crop for the cut-over lands, in the opinion of E. A. Sherman, of the U. S. Forest Service. Col. Joseph H. Pratt, Chapel Hill, N. C., was not quite so sweeping as Mr. Sherman, perhaps because he had North Carolina conditions more particularly in mind, but he did say that for at least two or three generations a large majority of the cut-over lands should be reforested.

The Everglades and Other Florida Reclamation—Jules M. Burguieres outlined the Florida Everglades problem, prefacing his remarks with the statement that these lands did not pass from federal to state ownership until 1903. The state now has title to about 1,800,000 acres of the Everglades, through which some of the needed drainage canals have been cut. In addition, there is an equal area needing drainage. The cut-over lands of Florida are increasing at the rate of 400,000 acres a year. The federal government should look into the economic need for reclamation in Florida and elsewhere.

Wet and Swamp Lands—Perhaps the easiest way to bring more land under cultivation, said S. H. McCrory, chief of the division of Agricultural engineering, U. S. Bureau of Public Roads, is the reclamation of wet and swamp lands. Of these there are in the United States about 100,000,000 acres, a large part of which require both reclamation and colonization.

Resolutions on Reclamation Policy—Of the resolutions adopted by the conference, the following two are of special interest as defining views on reclamation policy:

That we request Congress to consider the recasting of the entire reclamation law, making it applicable to all parts of the United States, eliminating the conditions which make speculation easy and which have encouraged tenantry and promoted soil deterioration, and at the same time extending the good features of the law so as to be applicable to the reclamation and best use of lands in whatever part of the country they may exist, such development to take place in time and manner best to promote the creation of opportunities for self-supporting and self-owned farm homes; also that the organization of a Reclamation Service be provided for by law and be placed on a permanent basis.

That full publicity and discussion be had of better methods of land settlement and provision be made under state laws for the organization of suitable semi-public bodies for taking option on desirable farm lands, appraising these, providing for favorable and easy prices and terms, preferably under some form of amortization, and that the condition of sale require actual settlement and cultivation under a system of agriculture found to be adapted to the locality.

Street Retaining Wall Founded on Fill of Large Boulders

Construction of Hillside Street in New York City Complicated by Riprap Fill at Site of Retaining Wall

BY HARRY W. LEVY
Engineer in Charge, Division of Design, Department of Public Works, Borough of Manhattan, New York City

NORTH of Washington Bridge, which crosses the Harlem River in the northern part of New York City, the easterly slope of Manhattan Island orginally descended precipitously toward the river. Amsterdam Ave., a few hundred feet west of the top of the slope, and part of the side streets east of it are well built up. In order that property lying 200 ft. east of Amsterdam Ave. might be provided with better street facilities, Laurel Hill Terrace, a new north-and-south street, was laid out, interposing a street between this property and the public park lands lying to the east along the Harlem

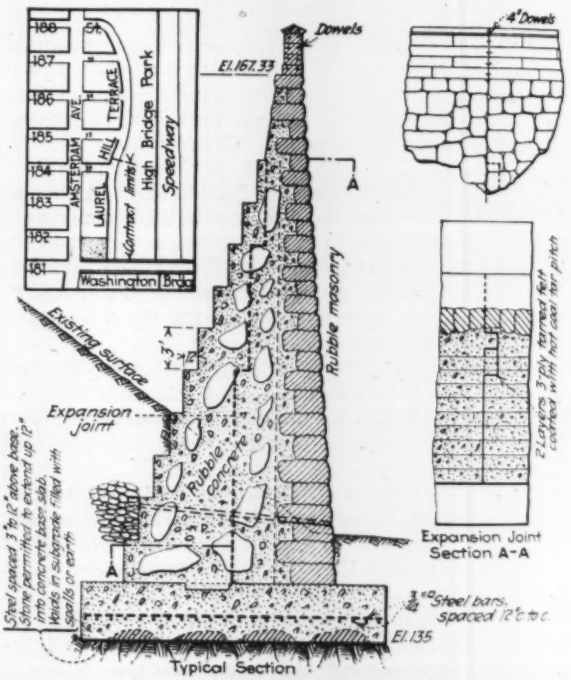
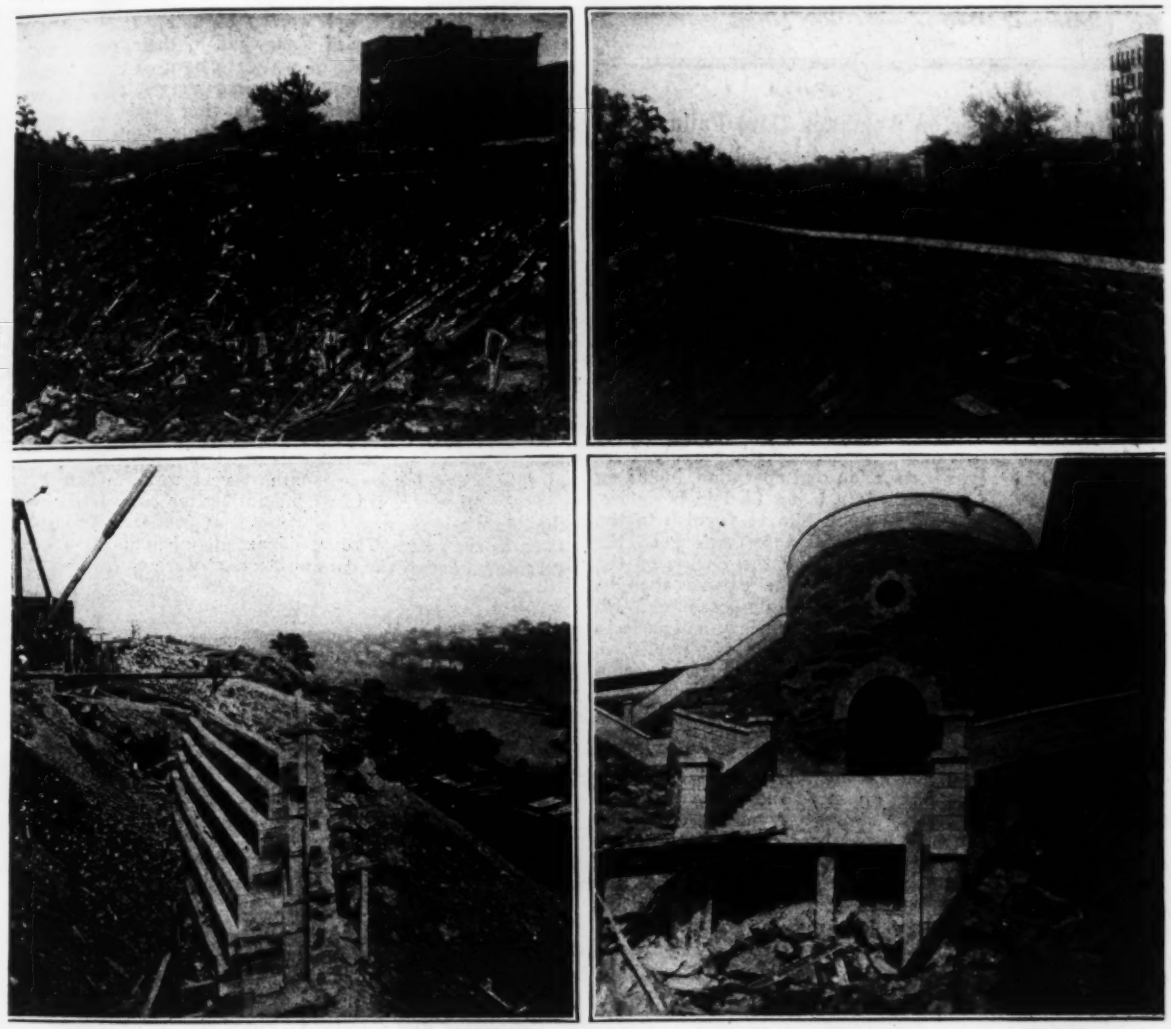


FIG. 1—LOCATION AND SECTION OF WALL
Greatest height of wall, 32 ft. 4 in.

River speedway. Existing street grades made it necessary to fix its elevation considerably above the original surface, and thus required the construction of a high retaining wall.

Before the grading of the street was taken up, large quantities of heavy rock fill and ashes had been dumped on the street site, filling the west part of it practically to grade, and sloping off into the park lands. To re-

move this mass of loose rock fill to the original surface, in order to construct retaining walls, would have necessitated excavations 50 ft. in depth through heavy riprap material of a sliding nature which could not readily be supported by sheeting on account of the steep slope in the subsoil with stone or earth to hold the wet concrete mix; the specifications allowed large stones to project 12 in. above the bottom of the mat. The effective depth of the mat is 28 in. and the reinforcing consists of ¾-in. square bars 12 in. on center both ways.



FIGS. 2 TO 5—LAUREL HILL TERRACE RETAINING WALL, A CONCRETE WALL BUILT ON OLD ROCK FILL
Upper left—Original condition of hillside; men standing on line of wall. Lower left—Rubble-faced wall on spread footing built directly on rock fill. Upper right—Finished wall, seen looking southward from park at 184th St. Lower right—Ornamental stair tower and park approach built at 184th St.

of adjacent lands. The rock fill extended to a considerable depth, and consisted mainly of large, rugged pieces of stone, several cubic yards in volume, such as are taken out in cellar excavations in gneiss. Exploration showed that large open voids existed throughout the mass, but the fill as a whole was stable, observation and levels indicating that there had been no appreciable settlement over a period of years. In view of this, it was concluded that by spreading the load over a considerable area of this fill by means of a reinforced-concrete mat foundation the retaining wall could be constructed thereon without any danger of settlement.

The retaining wall varies in height from 10 to 30 feet. Its foundation was so designed that in case of settlement the mat would support the wall over any void up to 20 ft. span. It was placed after filling voids

No expansion joints are provided in the mat but the wall above has expansion joints of two layers of three-ply tarred felt every 40 ft. The retaining wall is of rubble concrete faced with rubble. The parapet wall and coping consist of a portion of the old Central Park wall which formerly was in front of the Metropolitan Museum of Art, seated on a new granite wall cap.

Provision has been made for regrading the fill within the park area so that in future a park path may be constructed and the intervening slope between this path and the wall graded and sodded without exposing the retaining-wall footings. An ornamental double stairway approach to the park, of rubble stone and cut granite, is constructed at the northerly end of the wall.

The work was constructed by S. Rosoff and Clemente Contracting Co. at an estimated cost of $85,717.25.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

State Engineer on Apishapa Dam Failure

Sir—The Apishapa dam failure, described and discussed in *Engineering News-Record*, Aug. 30, p. 357, Sept. 6, p. 373 and Sept. 13, p. 447, which involved the total loss of the earth embankment primarily constituting the dam, again directs the attention of engineers to certain vital questions incident to the employment and maintenance of such structures which call for the most careful deliberation. Since the reports and comments thus far printed are more or less conflicting and indicate a somewhat confused impression of the situation, and since the writer has occupied the position of state engineer of Colorado and, consequently, ex-officio, that of consulting engineer for the structure, during its entire construction and operation period, being properly chargeable with responsibility for the plans and specifications adopted, and is, moreover, thoroughly familiar with the history, construction and operation, including repairs, of the dam, all such data being filed in his office, he feels that it is incumbent upon him to furnish to the engineering profession all essential information, to the end that correct conclusions regarding the causes of the failure may be arrived at and similar catastrophes be averted hereafter, so far as this is humanly possible. With this end in view it seems desirable to review, as concisely as possible, the more pertinent facts already published, adding such further detailed information in his possession as appears to be essential for a clear understanding of the problems involved.

Unfortunately, but perhaps unavoidably, the real issues have been considerably befogged heretofore by the publication of much that is extraneous to the vital questions, both in the reports that have appeared and in the comments thereon, and it seems best to eliminate from this discussion those features that have no direct bearing upon the failure of the dam.

It is conceded by all who have personally studied the situation and reported thereon that neither the matters referred to in the "protest and warning printed on the official record plans," mentioned in *Engineering News-Record*, Aug. 30, 1923, p. 357, and again, editorially, Sept. 6, 1923, p. 373, nor any of the appurtenances of the dam, such as riprap, cutoff walls, piling, spillway, freeboard, outlet tunnel, gates, drains, toes, etc., already sufficiently described in the earlier articles can be properly charged with any responsibility for the disaster; but the opinion that weaknesses of some kind or kinds existed in the earth embankment as constructed, and that these were primarily responsible for its failure, appears to be unanimously held. Therefore the writer will not discuss, at this time, any of these features not contributing to the failure, but will confine himself to those details which, in his opinion, bear some important relationship to what has happened. These details are as follows:

Nature of Dam—The dam was fundamentally an earth embankment having incorporated in it such appurtenances as were deemed necessary for the impounding and regulation of flood water for irrigation use, none of the appurtenances, however, being suspected of having contributed to the failure.

Construction—The embankment was constructed, so far as methods were concerned, in accordance with what were considered to be standard plans generally adopted among hydraulic engineers. The facts that three separate sets of specifications, all quite similar with respect to methods of construction, contemplating three distinct dams proposed for the site, each not to exceed 115 ft. in height, were prepared at different times by different engineers or firms of engineers; that these three sets of plans were separately approved by three different state engineers; and, further, that the first specifications regarding the points now at issue are said by one of the members of the firm that prepared them to have been in substantial conformity with the then more or less standardized specifications of the U. S. Reclamation Service, are worthy of note. It is true that the different sets varied somewhat in their requirements concerning the amounts of water to be used in moistening the earth and in some other minor particulars, but they were all practically identical in leaving to the engineer in charge the final decisions as to the requirements for spreading, sprinkling and rolling. The embankment was considered practically completed by Sept. 20, 1920.

Material—Two distinct varieties of earth, described in considerable detail in the earlier articles and to be referred to again later herein, were used in the construction of the embankment. The suitability of the earth is questioned, especially by J. E. Field. (Sept. 13, 1923, pp. 418 and 420.)

Storage of Water—The reservoir was filled gradually to gage height 65 ft. on Aug. 3, the surface being then lowered gradually until the gage height was 47.3 ft. on Dec. 28.

1922: The surface remained at approximately 46 ft. until about May 10. Little water was available for storage that year and the surface gradually lowered until about Dec. 15 when the reservoir was practically empty, remaining at that stage for some months thereafter.

1923: No water was stored until after June 1. Between that date and Aug. 2 the water rose gradually from 14 to 48 ft. on the gage. The significant gage heights from Aug. 2 till the failure of the dam on Aug. 22 were as follows:

Date	Hour	Gage, Ft.
August 2	.....	47.6
August 12	.....	60.0
August 14	.....	71.0
August 17	2 a.m.	71.3
August 17	7 p.m.	74.1
August 18	5 p.m.	75.7
August 19	9 p.m.	74.3
August 21	8 p.m.	75.1
August 22	3 p.m.	82.9

The water reached a gage height of 65 ft. on Aug. 3, 1921, after which it was drawn off gradually until it stood at about the 46-ft. level at the end of the year, where it remained until about May 10, 1922, then lowered to practically nothing at the end of that year, the reservoir remaining nearly empty until after June 1, 1923. It again reached the 1921 high-water stage of 65 ft. about Aug. 13, a little more than two years after it first reached that point. After Aug. 13 the water rose rather rapidly until, while still, according to the engineer in charge, about 11 ft. below the crest of the dam, the embankment failed at 3:00 p.m., Aug. 22, 1923.

Settlement and Cracking—The following details are abstracted from two letters dated respectively Sept. 14 and 16, 1923, from the engineer personally in direct charge of the project, A. N. Dallimore:

Following the time of maximum storage in 1921 two cross-sectional cracks developed, these being at distances of from 80 to 90 ft. from both the east and the west end of the dam respectively, each crack running from the water surface to the top of the dam, and the west one extending down on the back slope. These cracks were over the shoulders of the rock cliffs at points where the fills were much less than they were nearer the center of the dam and where the settlement might naturally be expected to be much less toward the ends of the dam than toward the center.

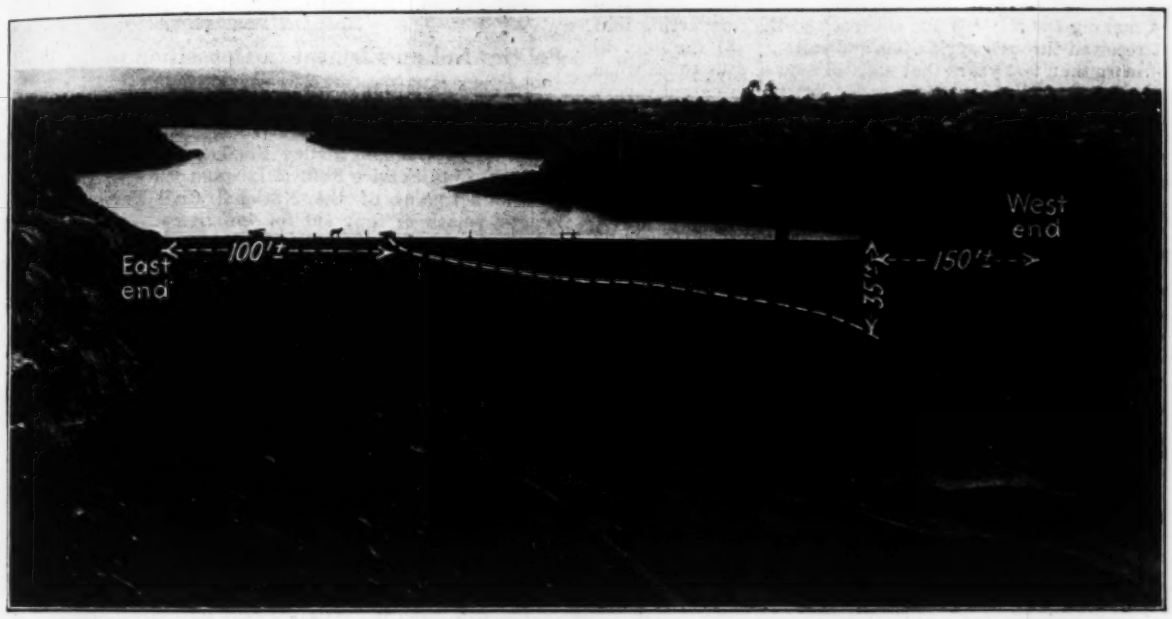
Another crack, running lengthwise of the dam and a little above the high-water mark, appeared also at the same time. Mr. Dallimore says that this crack was "probably caused by the fact that there was more settlement where the water covered the slope than on the slope above," and also that he considered it logical to expect such settlement cracks and did not consider them serious. He did not try to seal them up for some time, until he was sure they were not opening up any more. He then pumped water and

washed earth into them until they appeared to be entirely sealed. He reported that the maximum settlement of the dam up to May 10, 1922, "was about 2.5 ft., and about 3.5 ft. vertically on the slope at the water surface."

As the water rose above the 60-ft. gage height in August, 1923, there was some tendency to settlement on the front (water) slope at the west end of the dam, following the old crack there, and two very fine cracks showed on that end of the dam. These were the only cracks that appeared until just as the dam failed, when the diagonal crack described in the earlier articles opened up. The water entered the dam about 100 ft. from the east end and broke through the lower side at a point about 150 ft. from the west end.

the principal owners of the project and himself a graduate engineer, is quoted as being both pertinent and just:

"Regarding the care of the Apishapa dam by Mr. Dallimore, engineer in charge, will say that ever since he assumed charge of the company's system he has been at the reservoir frequently, and I know from conversations held with him that he was constantly on the lookout for settlement cracks in the dyke and fully appreciated that any such cracks which might occur would be possible sources of danger to the dam and should be given careful attention. I have asked him to report fully to you regarding what settlement cracks had occurred prior to the one which suddenly appeared and which caused the failure of the dam within a few minutes of its first appearance. I know of my own knowl-



APISHAPA DAM FAILURE: WATER JUST BEGINNING TO TRICKLE THROUGH NEAR THE WEST END

The water entered the dam near the surface about 100 ft. from the east end and immediately began to trickle out near the west end. The dotted line shows that the water traveled along that course until nearly 2,000 sec.ft. was running through before the dam began to slough off. This would indicate a heavy crack along that course.

Leakage—Mr. Dallimore makes these statements in his letter of Sept. 14:

"The quotation from *Engineering News-Record* of Aug. 30, as follows, 'Leaks attributed to settlement cracks had been observed a year ago. . . . These leaks were at each end of the dam and about 25 ft. below the crest,' is not correct, as at no time, until just as the dam failed, has there been any leak through the dam. Some seepage developed through the rock cliffs in July, 1921, and occurred again this year when the water got up in the reservoir. On the west cliff this seepage was very slight and through the east cliff was about 2 sec.-ft. This seepage came through seams in the rock and was at all times entirely clear, carrying no sediment. It was carried off in ditches and did not get into the earth fill. [There had been no water at any elevation like 25 ft. below the crest between August, 1921, and August, 1923—A. J. McC.]

"At no time had there been any seepage at the toe of the dam, except through the drainage pipe in the old channel bed. At the time of the failure there was not to exceed 1 sec.-ft. coming through this pipe.

"The tunnel has shown no signs of soft spots or of seams washing out, at least up to the last few weeks, during which time we have had some large heads discharging. Eighty feet of the tunnel is lined below the gate chamber and I doubt if it will ever be necessary to line any more."

Supervision of the Dam—The following extract from a letter dated Sept. 14, 1923, from H. H. Knowlton, one of

edge that three hours prior to the failure there were no cracks showing along the line where failure occurred and Mr. Dallimore and the caretaker both told me afterward that they had inspected the whole dam looking for cracks after I did and within a short time prior to the break and that nothing showed at that time.

"After considerable water was in storage this summer Mr. Dallimore greatly increased the time and attention given to the reservoir and was always there to personally superintend the work when the weather gave indications that a flood might occur; and during the ten days prior to the break, during which time the water was being held at a level about 10 ft. lower than the spillway, he was at the dam practically all the time, day and night, and several nights did not even have his clothes off to sleep as he made frequent inspections of the dam during the night. He did this even though nothing had occurred to cause any real uneasiness regarding the safety of the dam. There was about 2 sec.-ft. of water seeping through the rock around the east end of the dam and coming out of the hillside in the form of clear water springs which did not touch the lower slope of the dyke, being carried away by ditches on the side hill. From two personal inspections of the dam made within two weeks prior to the break I know that the lower slope of the dam was entirely dry and that not to exceed 1 sec.-ft. of clear water was coming out of the drain pipe at the bottom."

All the evidence in this case leads to the conclusion that

the vital trouble was in the embankment alone and that 5 ft. more added to the height of the dam, or changes in the construction of the toes, would not have averted the disaster. It appears to be certain, also, that there had been no leaks through the body of the dam prior to the time of the break that would have given warning of impending danger. Nor does there seem to have been any upward pressure of any importance under the dam as suggested by Mr. Godfrey. (*Engineering News-Record*, Sept. 13, 1923, p. 447.) Indeed, Mr. Godfrey's premises with respect to the Apishapa dam being incorrect, his conclusions in this particular case have no bearing on the questions at issue.

Conclusions—In the light of the evidence and studies now given to the case, several items attract particular attention. These are: (1) The character of the earth used in making the fill; (2) the efficiency of the compacting that it received through sprinkling and rolling; (3) the interval of more than two years that elapsed between the times when the water reached the 65-ft. level; (4) the apparently very considerable settlement that took place after the water reached that level in 1921, and the development of cracks that appeared at that time; (5) the apparently unhampered flow of water into the dam soon after it rose above the same level and its practically immediate discharge at a somewhat lower level on the lower side of the dam nearly at the opposite end, both inlet and outlet being nearly enough on line with the bluffs to arouse a strong suspicion that settlement cracks and, possibly, cleavage planes along those lines in combination with an internal longitudinal crack, were largely responsible for the failure.

Compacting—Reviewing the situation, it now appears to the writer that the earth of which the embankment was composed should have been thoroughly compacted by means of a pool of water along the center line of the embankment, or, at least, by the utilization of optimum amounts of water, determined by trial. It appears to him to be reasonably clear that there was internal settlement and cracking when the reservoir was first filled to the 65-ft. level, caves forming inside the dam, the upper 50 ft. of which had been just sufficiently solidified by sprinkling and rolling to hold together without external cracking, possibly somewhat in an arch form. It seems probable that the water did not stand long enough at the higher levels in 1921 to saturate the entire body of the dam below the 65-ft. level, so there may have been a slight cantilever action in the upper portion of the embankment. The company, believing that there would be no further settlement below that level after the cracks had apparently been sealed, proceeded to add more material to the surfaces to compensate for the settlement, not suspecting the serious condition inside the structure.

These conclusions are presented, not with a view to fixing the blame upon any one connected with the work, but solely for the purpose of determining the nature of the fault in construction that was responsible for the failure. The state engineer will be blamed by some on the ground that the supervision was inadequate or incompetent. It must be remembered, however, that there are over 900 earth dams in Colorado that are under the supervision of the state engineer; that a number are usually being constructed at the same time; and that superintendents or inspectors appointed by the state engineer cannot, legally, be paid more than $5 per day—hardly laborers' wages. Consequently much must be left to the owners and their engineers in direct charge. The state engineer's office can devote no more money or time to such work than it is now giving. In this particular case it was believed that those in charge of construction were more than usually competent, as, indeed, they were. The fact is that in forty years' experience as an irrigation engineer, more than ten years of that time as state engineer of Colorado, the writer has never before known of a failure like this one. He sincerely hopes that this may furnish such an object lesson to the engineering profession that there will never be another failure like it.

This discussion would not be complete without a word regarding the gates. It has been suggested by some that they should have had a greater discharge capacity. The writer does not believe this to be true. It is granted, of course, that the embankment should have been so constructed that there would have been no danger of failure short of actual overtopping by some totally unprecedented flood. Granting this, it is to be remembered that the spillway capacity is practically unlimited and that the reservoir was intended to be a stream-bed reservoir for the conservation of flood waters. The gates were sufficiently large to furnish water for all prior rights along the stream below the reservoir, with an unsually large margin of safety. Under the existing circumstances, and assuming the dam to be properly constructed, there would seem to be no good reason for any larger outlet capacity. In short, the responsibility for the failure must be charged to the faults, whatever they may have been, in the embankment alone.

A. J. McCUNE,
Denver, Colo., Oct. 1. State Engineer.

Politics Not an Element in Opposition to Dr. Work

Sir—The following statement attributed in your issue of October 18, in an article "Work's Friends Justify Davis' Removal," to friends of Dr. Work, has just come to the attention of William Dudley Foulke, the president of the National Civil Service Reform League:

"The activities of the National Civil Service Reform League smack of first aid for the Democratic party. All its representatives who have called on Dr. Work have admitted affiliation with that party."

In reply to this statement, Mr. Foulke, who, as you probably know, was a close friend of Colonel Roosevelt, and who served as a member of the United States Civil Service Commission during the Roosevelt administration, has asked me to send you this statement:

"This statement is false. I was one of these representatives and no such affiliation was admitted by me, nor did it exist. I called on Dr. Work with two other members of the League. He asked me the question, 'What are your politics?' I told him I was an Independent. He said, 'That means you are a Democrat.' I answered that it did not, that I had been strongly opposed to the administration of Woodrow Wilson, to which he rejoined, 'Oh, that was a mere personal objection.' In fact, I have never voted the Democratic ticket since the administration of Grover Cleveland, but always either the Republican or the Progressive ticket. Dr. Work must be in hard straits if he finds it necessary to defend himself by the statement of an affiliation which he well knew did not exist."

I hope you may find Mr. Foulke's statement worthy of use in your publication. RICHARD BOECKEL,
Washington, D. C., Washington Representative,
Nov. 23, 1923. National Civil Service Reform League.

Stanton's Expedition Down The Colorado

Sir—I note in your issue of Nov. 15, 1923, p. 787, under the heading "Engineering Plus Adventure" it is stated, "When it is remembered that the trip itself, devoid of any of the surveying accessories, has been made only two or three times and, with the exception of the pioneer Powell trip, *only as an adventure*, the Birdseye expedition becomes a notable addition to the annals of engineering."

The writer is evidently unaware of the notable expedition under the direction of the late Robert B. Stanton, M.Am.Soc.C.E., who made a most thorough and exhaustive survey and examination of the Colorado River and its canyons in the years 1889 and 1890, for the purpose of locating a low-grade railroad line to the Pacific Coast.

See *Transactions*, Am.Soc.C.E., Vol. 26, p. 283, also *Engineering News*, Oct. 18 and 25, 1890.

Port Chester, N. Y. F. S. ODELL,
Nov. 20, 1923. Civil Engineer.

[The writing of Powell instead of Stanton in the editorial noted was a slip of the pen. Major Powell's famous exploratory trip down the canyon in 1869 was in no way a survey, but Mr. Stanton made a most thorough survey in 1889-90 for a possible railway. In the numbers of *Engineering News* referred to there are some excellent views of places in the canyon which have since become quite noted in engineering discussions.—EDITOR.]

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

News Brevities

Construction of a Concrete Power house and earth dam to develop a head of 62 ft. on the Manistee River near Cadillac, Mich., is contemplated by the Consumers Power Co. of Jackson, Mich.

Oregon City, Ore., Has Adopted the city manager plan and the city will elect a mayor and a treasurer Jan. 1 1924. The mayor will appoint a city manager, who will name other city employees.

One of the Longest Ferro-Concrete bridges in England has been opened at Reading. The bridge crosses the Thames at a point which connects Reading with lower Caversham on the Oxfordshire side of the river.

To Keep Connecticut River Flood water back from the sewers in streets, covering an area of 328 acres, the Springfield, Mass., city council on Nov. 12 voted to appropriate $79,000 for a pumping system and accompanying equipment. The system adopted was recommended by Metcalf & Eddy, engineers, Boston, Mass.

Several Weeks Probably Must Elapse before it will be possible for the State Department to call the proposed conference on oil pollution. The assembling of necessary data and reports is not yet complete. It is believed, however, that the situation has resolved itself largely into a matter of prescribing the mechanical devices necessary to make proper oil disposal comparatively easy.

An Important Civic Project at Dallas, Tex., is the extension and widening of Field St. from Main St. to Orange St. and Cedar Springs Ave., in order to provide a new cross-town route in the shipping and banking district. At present there is no continuous opening along this route and much of the property is occupied by barns and sheds which would be replaced by modern business buildings. This improvement was recommended by the late George E. Kessler, landscape architect, and it is now being urged upon the city by the Dallas Property Owners Association, of which E. N. Noyes is engineer.

In the Case of George W. Clark against the Green Briar Drainage District of Jasper and Crawford County, Ill. Mr. Clark has been awarded $25,000 damages by a jury in the U. S. District Court at East St. Louis, Ill. He constructed a levee for the district several years ago and the district claimed that the levee was unsatisfactory and declined to pay the full amount due under the contract. Two years ago Mr. Clark obtained a judgment for $30,000 but the Federal Court of Appeals remanded the case for a new trial. Counsel for the levee district has now filed a motion for retrial.

Chicago Rapid Transit Extension

A 5½-mile surface line extension of the Chicago elevated railway system is to be built in Evanston and Niles Center, under the name of the Chicago, North Shore & Northern Ry. From the present Howard St. station on the elevated system the new line will descend on an incline and run west to Niles Center, where it will turn north to a terminal at Dempster St. A site of about 55 acres has been secured for car shops for the elevated lines and the interurban line of the Chicago, North Shore & Milwaukee Electric Ry. An extension to Waukegan is projected, giving the latter railway an alternative route for its limited trains between Milwaukee and Chicago. Application has been made to the Illinois Commerce Commission for the necessary authority. The work will be under the direction of B. J. Fallon, general manager of the Chicago Elevated Railways.

Power Commission Grants More Licenses

A license to develop 29,000 hp. on Cascade Creek, 22 miles from Petersburg in Alaska, has been granted to Hutton, McNear & Dougherty of New York City and San Francisco. The license is conditioned upon a contract with the U. S. Forest Service for the purchase of timber as the power is to be used for the manufacture of pulp and paper. The project will consist of a dam, reservoir, a conduit 14,250 ft. long, and a power house and pulp mill.

A preliminary permit has been granted to the West Virginia Power Co., of Charleston, covering a project on New River, five miles above Hinton, W. Va. The erection of a dam 140 ft. high and 750 ft. long is contemplated.

Another preliminary permit has been granted to Mary I. Crocker and J. W. Preston, Jr., of San Francisco, Calif., for a power project on the Mokelumne River and Sutter Creek within the Stanislaus National Forest, consisting of three reservoirs and three water conduits. The first conduit is approximately 22 miles in length with a capacity of 400 sec.-ft., the second approximately 7 miles in length with a capacity of 750 sec.-ft., and the third approximately 9 miles in length with a capacity of 350 sec.-ft. Three power houses will be built, the first to utilize a head of approximately 1,175 ft., the second 632 ft., and the third, 565 ft. The estimated total ultimate installation for the three is 48,000 hp.

To facilitate the handling of minor power projects the Federal Power Commission has authorized its executive secretary to issue licenses for ten years covering projects with a capacity of less than 100 hp., and field offices to issue licenses for ten-year periods covering projects of 40 hp. or less. If there is a possibility of the smaller projects conflicting in any way with larger projects the license is to be limited for five years.

Highway Officials Puzzled by Federal Reorganization Plan

Washington Correspondence

State highway officials apparently are in a quandary, judging from letters being received in Washington, as to the attitude they will take toward the proposal to transfer the Bureau of Public Roads from the Department of Agriculture to the Department of the Interior. They are inquiring as to whether their work will be simplified under the arrangement being sponsored by the administration, whereby they will have to maintain contacts with two Cabinet members instead of one. In addition to this proposed transfer the reorganization sets up a Bureau of Transportation in the Department of Commerce, which is to deal with railroads, waterways and highways.

Due to the large volume of business which must be transacted with the federal government in carrying out the multitudinous activities surrounding construction projects of the magnitude of those provided in the program for the federal-aid highway system, very close co-operation must be maintained by state officials with those of the federal government. For this reason, state highway officials are showing very active interest in the reorganization plan.

In some states the rural population already has importuned the state highway commissions not to agree to the transfer of the Bureau of Public Roads from the Department of Agriculture. In those cases the attitude has been that the highway is a more important factor in the conduct of farming operations than it is to any other activity. The contention is that the Secretary of Agriculture could be relied upon more than any other cabinet officer to champion policies which would give farmers good highway facilities without saddling on them a disproportionate amount of the cost.

Richmond, Va., Seeks Aid for Its Port Development

The city of Richmond, Va., acting through its council committee on dock, river and harbor, has retained the Technical Advisory Corp. of New York to make a port and industrial survey of Richmond and its environs.

The investigation is aimed at two purposes: (1) To secure the aid of the federal government in improving the James River; and (2) to formulate a plan for the industrial development of the city.

As a result of the survey, which was started in September Richmond hopes to convince the board of army engineers and Congress that a substantial appropriation for the improvement of the James River will be warranted. It will be the purpose of the city, if the desired river improvements are made, to provide an adequate modern terminal.

Construction Under Way on Pit No. 3 Project

Half of Railroad Complete—Work on Tunnel Being Advanced — Drilling at Dam Site

Construction is going forward rapidly on tunnel and preliminary work for the Pit River plant No. 3 in northern California. This plant is fourth in the Pit River series which is being built by the Pacific Gas & Electric Co. as power demands on the system require. The location and features of the proposed development as a whole were outlined in *Engineering News-Record*, Oct. 13, 1921, p. 604 and the Pit No. 1 plant was described in the issue of Oct. 5, 1922, p. 570.

The first half of the 10-mile railroad necessary to reach the Pit 3 power house was completed Sept. 1, bringing rail head to headquarters camp at the diversion dam site, which is also the upper end of the four-mile tunnel. The remaining five miles of railroad which involves heavy construction through the Pit River Canyon is to be completed by Jan. 1.

Work on the tunnel is now being advanced from the intake portal, from two portals at Rock Creek, 1¾ miles below, and at the adit about a mile below Rock Creek. Work at the lower end will not be begun until the railroad reaches that point. On Oct. 20 the intake heading was in about 600 ft. The tunnel is being excavated to a 21x21-ft. horseshoe section; it will be lined with concrete and will probably require timbering for most of its length. The first 600 ft. was largely through volcanic tuff and diamond drilling indicates that the same material will be encountered for another 600 ft. after which lava and basalt are expected.

Contractor Furnished Equipment

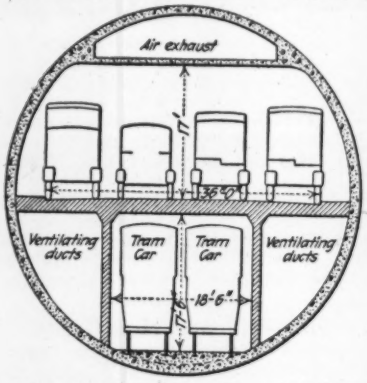
In order to insure having equipment on the job suitable for the several tunnels contemplated in this vicinity the power company decided to furnish the contractor on this tunnel with all heavy equipment, such as compressor plant, steam shovels, muck cars, etc. and to build such camp structures, roads, railroads, inclines, etc. as may be required. Small tools, drill steel, power, etc., are to be furnished by the contractor. Under this plan of operation it will not be necessary to let the work in such large blocks. Contract for a total of 2,000 ft. of tunnel at Rock Creek and the adit now under way is held by the Bates & Borland Co. The power company is driving the intake heading with its own crews.

Diamond drilling at the dam site indicates that foundations will go about 25 ft. below stream bed. A gravity-type concrete dam 125 ft. high is contemplated. While foundations are being placed the stream is to be carried in a flume about 12x30 ft. in section and 1,200 ft. long of which the upper 800 ft. at the dam site probably will be made of concrete as a safeguard against interruptions during the short low-water season. The capacity of the flume will be 3,000 sec.-ft., this capacity being about 20 per cent in excess of the normal low-water flow. Half of the heavy rock cribs for the temporary diversion dam are now in place; the remaining cribs will be placed in April or May of next year.

Pit River No. 3 power house is to contain three 27,000 kva. generators driven by vertical reaction wheels operating under a static head of 313 ft. and is to be in service Oct., 1925. Construction work on the project is under the direction of O. W. Peterson.

Mersey River Tunnel Proposed

A project for a highway tunnel under the River Mersey to connect the cities of Liverpool and Birkenhead, England, provides for a single bore 44 ft. inside diameter. It would be located a little downstream from the Mersey Ry. tunnel, and would have a river length of about 4,000 ft., with long approaches or grades of 5 per cent for light traffic and street cars and 3 per cent for a lateral approach carrying heavy traffic of the docks district. At the centerline of the tunnel section would be a 36-ft. deck wide enough for four lines of vehicles and two narrow sidewalks. Two supporting walls for this deck would form a central section for street cars and two side sections for ventilating



PROPOSED MERSEY RIVER TUBE

ducts. About 17 ft. above the upper deck would be a flat roof or ceiling forming an air exhaust duct along the top of the tunnel.

It is proposed to have a cast-iron shell with interior concrete lining and with grout pumped to fill all exterior voids. The total cost is estimated at $32,000,000. The consulting engineers are Sir Maurice Fitzmaurice, Basil Mott and John Brodie.

Legal Obstacles Removed in Extending Minidoka Project

Extension of the Minidoka reclamation project in Idaho to overflow part of the present site of the town of American Falls may proceed, legal obstacles having been removed by the decision of the Supreme Court Nov. 12 in the suit of DeWitt Garrison Brown and Rosa C. Brown against the United States.

Because extension of the project would inundate part of American Falls, a town of 1,500 inhabitants, Congress passed a special act authorizing the Reclamation Service to condemn land adjoining the town to which land three-fourths of the town would be removed. Proceedings were begun to condemn a farm owned by the Browns. The jury awarded them $6,250 and, under Idaho law, $328 for interest. The Browns resisted and filed suit to resist the condemnation on the ground that the proposed use of their land did not constitute public interest. This contention the Supreme Court held to be wholly erroneous.

Non-Partisan Board Selects New New York Roads

Approximately 1,000 miles of new state highways will be added to the New York State system of good roads during the next eight years if the program approved by a non-partisan committee, named by Col. Frederick S. Greene, superintendent of public works, of New York State, be approved by the legislature. The committee named is as follows: H. Eltinge Breed, representing American Society of Civil Engineers; W. F. Wilson, representing County Highway Superintendents Association; C. W. Hawes, representing Dairymen's League; C. O. Kramer, representing Motor Truck Association of America; Charles W. Leavitt, Jr., representing New York State Association of Real Estate Boards; Frank M. Baucus, representing New York State Automobile Association; F. J. Riley, secretary, New York State Grange; B. W. Miller, representing Federation of Farm Bureaus; and T. H. Bennet, representing Motor Federation.

The committee met at Albany on Nov. 20 and approved a majority of the proposed development, cost of which is estimated at from $45,000 to $50,000 per mile. About 400 miles of additional roads are still to be approved and will be considered by the committee at a meeting Dec. 11.

Colonel Greene, in opening the meeting, told the committee that it was to have the entire say in the selection of the roads proposed by his department, county superintendents of highways and division engineers.

"The highway department will not have a vote in the matter" said he. "What we aim to do is to stop building roads to placate those who have political power and to end the construction of deadhead highways."

To bring about a consummation of the plans for the additional roads, legislative enactment will be necessary including a change of the map of the ultimate system of state and county highways and an amendment to the highway law inserting therein the new routes proposed.

Railroad Denied Right-of-Way in Salt Creek Oil Fields

The Department of the Interior has denied a right-of-way across the Salt Creek oil fields in Wyoming to the North & South Railroad Co., a new railroad 332 miles long now building from near Casper, Wyo., in Miles City in Montana. The reason for the denial of the right-of-way across 20 miles of the Salt Creek field is based on the fact that the public lands in the Salt Creek field have been reserved and that, because of this reservation, the law does not sanction the building of a railroad across it. Another ground for the refusal to approve the map as submitted by the North & South Railroad Co. is the fact that the railroad would interfere seriously with the development of oil in the fields and the rights of the oil lessees, according to the Department of the Interior. As one of the chief objects in building this railroad was to provide the oil fields of the Salt Creek area with an outlet, it is probable that a way will be found to circumvent the technicalities now standing in the way of this construction.

Federal Employees Protest Personnel Classification

Washington Correspondence

A storm has been precipitated by the action of the Personnel Classification Board in reversing its attitude toward tentative reclassification of civilian employees of the federal government outside the District of Columbia. Following a mass meeting in Washington, a committee representing the National Federation of Federal Employees sent a formal protest to the board and asked President Coolidge to order an investigation, declaring that the reclassification act was being disregarded. The change in policy by the board affects only federal employees outside the District of Columbia. In preparing a report for Congress regarding reclassification of these employees, the field division of the board, under the board's instructions, prepared specifications for the various kinds of work and called for allocations by heads of divisions under these specifications, whereby the same rates of pay would be given for comparable work and responsibility regardless of the department or place where this work is performed. With about 60 per cent of the reports at hand, the division sent a tentative report to the Budget Bureau for its information in formulating departmental and bureau budgets for 1925. The District of Columbia Division proceeded differently, classifying employees by departments and bureaus according to present duties and pay, leaving for the future the specifications for comparable work by which inequalities will be removed. The District schedule is to go into effect July 1, next, while the law called for a report, only, as to the field forces.

On Nov. 13, the Board, by a vote of two to one, directed that estimates be prepared for the field forces on the same basis as was used in the District of Columbia Division in order that more complete estimates of cost might be at hand in the event Congress did not provide a bonus for field workers.

Levees and Drainage for the Arkansas River

Reclamation of the overflowed lands along the Arkansas River in Kansas is of increasing importance to the industrial development of cities along the river as well as to agricultural development, and a co-operative movement for such work has been taken by the organization of the Arkansas Valley Improvement Association to co-ordinate the various interests and communities and to assist in organizing a number of drainage districts to carry out the works. Levees and bank protection are needed, and ditches and levees to take care of the runoff from hill streams whose natural channels are of insufficient capacity. One most perplexing problem is the reconstruction of bridges in and adjacent to the larger cities, such as Wichita, Larned, Hutchinson and Arkansas City, since the majority of these bridges are inadequate to pass flood discharges. R. H. Rhoads, Arkansas City, Kan., is secretary of the Association and the Clark E. Jacoby Engineering Co., Kansas City, Mo., acts as consulting engineer. This company has already submitted plans for flood control at Wichita, Kan., and for levee works at Larned.

Ford Bid for Muscle Shoals Gains in Favor

With the chairman of the Appropriations Committee of the House of Representatives actively advocating the acceptance of the Ford offer for the government's properties at Muscle Shoals, the prospect of the acceptance of that offer by Congress is increased. Entirely apart from the importance of his position, Chairman Madden possesses powerful influence among the conservative Republicans, the portion of the House membership relied upon to defeat the Ford bill.

In conversation with the Washington correspondent of *Engineering News-Record*, Mr. Madden admitted that he is not informed as to the important offers for Muscle Shoals which are said to be in prospect but he reiterated his belief that Mr. Ford is in a better position than anyone else to develop that property. Mr. Madden confirmed the statement carried recently by the Associated Press, to the effect that he is backing the Ford offer principally because of its fertilizer feature, under which Mr. Ford would be required to make an immediate investment of some $50,000,000. The government can afford, Mr. Madden believes, to write off its expenditures at Muscle Shoals if it assures the farmers adequate supplies of fertilizers at low cost.

Scuthern Pacific to Complete Double Track Over Sierras

The Southern Pacific Co. is now completing the double tracking of its main line over the Sierra Nevada Mountains. This involves the building of a new second track from Blue Canyon to Truckee, a distance of about 41 miles. Portions of this new work, from Blue Canyon to Emigrant Gap and from Andover to Truckee, totaling 12.7 miles, have recently been completed at a cost of about $1,200,000. The final section from Emigrant Gap to Andover, a distance of 28.7 miles, will cost about $10,800,000, or an average cost for the 41 miles of about $290,000 per mile. Double tracking on this section of the line has been left until the last because it involves the heaviest construction in the mountains. The completion of this project, which is expected in about two years, will give a continuous double track from San Francisco to Sparks, Nev.

Throughout this double-track work improvements have been introduced in the form of reduced curvatures and decreased lengths of snow sheds. About two miles of the second track at the summit will be on a newly located line in tunnel under Donner Peak. This new location which will be used by eastbound traffic will lower the summit by 135 ft. The existing main line over the tunnel will continue to be used by westbound trains. Several short tunnels will also be driven for the second track, the one between Donner Lake and Cold Stream being 877 ft. long.

Other features of the work are three steel viaducts as follows: Across Butte Canyon 410 ft., across Lower Cascade 403 ft. and across Upper Cascade 298 ft.

Grading and tunneling on the new work will be done by contract; viaduct and track work will be done by the railroad under the direction of G. W. Boschke, chief engineer, and W. H. Kirkbride, engineer maintenance-of-way.

China Relief Commission to Construct Utilities

American Engineer to Be in Charge of River Control and Highway Work

Oliver J. Todd, a member of the American Society of Civil Engineers, has been appointed by the executive committee of the China International Famine Relief Commission to take charge of the engineering work of the commission in North and Central China. This commission was organized in the fall of 1921 to take over the work of six or eight organizations which have been handling famine relief work during and after the great famine of 1920-21. It took over the funds of these several commissions and is now using the unexpended balance as a revolving fund for river-control work and for highway construction throughout the provinces of North and Central China, where the menace of flood and the lack of highways are the contributing causes to famine.

The new program contemplates immediate investigations and surveys of various public utility projects, such as river control for the Yellow River and other large streams, irrigation projects, and an extensive network of highways. This will necessitate the establishing of local engineering bureaus in each of the provinces where the commission will carry on its work. In these local bureaus Chinese engineers will be employed and their work directed by the Peking headquarters. The Peking office will be in charge of Mr. Todd and he will have two or three American engineers as assistants and also several Chinese engineers who have been working with him in China during the past four years. It is expected that some of the river-control work will be started in the spring as famine-prevention measures and other work such as highway extensions will be undertaken only as relief measures in districts where subnormal crops make some relief desirable. The commission expects to continue its policy of employing famine sufferers on this work and paying them in grain.

Additional funds for the prosecution of this work will be raised in two ways: First, by annual contributions from Chinese provincial relief societies, and, second, by having a portion of the new customs increase of the Chinese Government allotted to the work of the commission when the increase is approved. It is estimated that about $750,000 a year will be available.

Belle Isle Bridge Opened

Detroit's new $3,000,000 Belle Isle bridge connecting the main land with Belle Isle was formally opened to traffic on Nov. 1, following ceremonies and a parade across the bridge, which marked the close of 27 months in building and 25 years' agitation for a new structure. At the conclusion of the ceremonies, a procession estimated at 10,000 people crossed the bridge on foot.

H. H. Esselstyn, engineer in charge of the construction of the bridge presented the bridge to John W. Reid, commissioner of public works. Tribute was paid to Greiling Bros., builders of the bridge.

Reclamation Advisers Believe Settlers' Relief Necessary

Washington Correspondence

Witnesses appearing before the Special Advisers on Reclamation apparently have convinced that body that prompt relief must be found for some of the projects. Governor Campbell, chairman of the advisers, suggests that some type of moratorium may have to be arranged. At the initial conference with the press last week, Governor Campbell pointed out that the work of the advisers thus far largely has been along the lines of research. Enough testimony has been heard, however, to convince Gov. Campbell that something must be done promptly to reorganize the fiscal principles under which the reclamation projects are being operated. Despite the rather hopeless situation in which many of the settlers find themselves, Gov. Campbell declared the demand for repudiation is negligible.

One of the points brought out by witnesses before the advisers is the matter of the efficiency of the individual farmer. Under the law no selective process can be employed in the choice of settlers. Apparently there is a new realization that the success of a farming enterprise on a reclamation project depends to a greater extent than on the average farm on the ability of the individual farmer. Inclusion of land of doubtful value is a source of weakness in some projects, the evidence presented by witnesses would indicate. Other witnesses contend that construction costs are excessive. All agree, however, Chairman Campbell stated, that the work is well done, but some contend that it is done too well.

Formulate Principles to Underlie Building Trade Apprenticeships

General principles which it was agreed should underlie apprenticeship training in the building trades were formulated at a conference in Washington Nov. 15 between the Federal Board for Vocational Education and representatives of employers and employees and material supply manufacturers.

Eight general principles were laid down. They are:

1—That a local representative committee composed of all interests in the industry is essential to determine the needs and supervise the training.

2—That part time or evening schools should be provided to supplement job training.

3—That all-around training is more desirable than specialized training.

4—That the national associations should set up fundamental training standards for apprentice training and make the information thereon available for instructional purposes.

5—That co-operation with the public schools is essential to the promotion of apprentice education.

6—That incentives should be set up to induce boys to enter apprenticeship.

7—That pre-employment training for employed apprentices or boys under contract is recommended.

8—That emphasis should be placed on dull-season training to follow up the initial training given in the pre-employment period.

A number of those attending the conference, which was called for discussion of the apprenticeship problem rather than for immediate definite action, recited plans which have been followed in various trades at specific localities to induce more young men to enter apprenticeship, or which have been devised to be put into operation soon.

N. Y. Central Offers Plan To Solve West Side Problem

The New York Central R.R. has offered a plan to the Transit Commission of New York City whereby solution of its so-called West Side trackage problems is to be accomplished through elimination of tracks from city streets, increase in freight transportation facilities and abandonment of certain terminal structures and track. Principal features of the proposed reconstruction, which, with grade crossing elimination it is estimated will cost $75,000,000, are a two-track elevated line from the new terminal at West and Spring Sts. to the 30th St. yards (which are to be double-decked); a four-track elevated line from 30th St. to 59th St., and from there widening of the right-of-way to allow installation of five tracks to another elevated structure at 116th St.

City Managers Hold Convention

Discussion of literally scores of problems which confront city managers constituted the feature of the tenth annual convention of the City Managers' Association, held recently in Washington, D. C. The discussion was divided into three parts, dealing with problems common to communities of 15,000 population, of 10,000 population and of 5,000 population. Particular interest was shown in markets, trees, lights, zoning, disposition of refuse, and water supply. Parks, bridges, schools, hospitals, reformatories and the various city departments were visited. A considerable portion of the time of those in attendance at the convention was spent on inspection trips.

Joint sessions were held with the National Municipal League and the Government Research Conference.

To Seek Aid for Government Barge Lines

Washington Correspondence

An effort will be made at the forthcoming session of Congress to secure legislation which will provide a new basis for the operation of Government barge lines. The Secretary of War now is considering the draft of the bill which would provide the Mississippi-Warrior services with a larger amount of working capital. It also provides that while the management still is to be vested in the War Department, it will be freed from departmental restrictions so as to be able to exercise a control similar to that employed in private enterprise. If the management can be arranged so that it may have the advantage of more direct control, it is believed a much better showing can be made.

A determined effort will be made at this session of Congress, it is understood, to set up a policy which will permit the War Department to do pioneering in inland waterway transportation on other streams. An argument which will be advanced in support of the plan is that this provides a cheaper way of expanding transportation facilities than would the construction of additional rail facilities to handle an equivalent tonnage.

Random Lines

Brothers Under Their Skins

"There is a demand in the church for a new type of worker—the *'socio-religious engineer,'* D. J. Beebe, dean of the school of theology, Boston University, declared today at the annual meeting of the board of home missions of the Methodist Episcopal Church. The *'socio-religious engineer,'* the speaker said, has special skill in relating the church to the whole life of the community and can deal with community problems from the religious point of view."—From the Boston *Herald.*

Now if he could only fix up a partnership with our old friend the *"hymn book engineer,"* they ought to get most of the business in their line.

* * *

A Live Profession

The propaganda of our brothers the exterminating engineers might well be emulated by some of the older branches of the profession. They have one virtue, certainly; they get publicity. All over the country the newspapers are carrying their advertisments, but more than that they are getting free advertising —such as this column gives, for instance. And we find a department editor of the Duluth *Herald* rather timorously assuring a correspondent that "it would be stretching the term to call this kind of a job a 'profession'". Profession or not, it has a nice new seal, which is shown in the accompanying reproduction.

* * *

The Triumph of the Concrete Ship

The 3000-ton concrete ship "Sapona," built at Wilmington during the war, has achieved a notable end. She has been bought by a Florida hotel keeper and will be located on Ajax Reef, 24 miles south of Miami Beach. The owner is going to fit her out with a "reasonable amount of furniture and equipment and use her as a fisherman's club house." And Bimini only 50 miles away.

* * *

Every Man To His Job

NOTE: An attempt by an engineering society to get its members to write an engineering short story or novel by offering substantial prizes has met with disappointing results.

The engineers, they have no fears,
They wear thick leather panties.
They spend their time in tropic clime
And live in wooden shanties.
Meanwhile just look, on screen, in book
Is told their tale romantic
By scribblers gay so dumb that they
Drive engineers near frantic.
But why in hell cannot they tell
These tales like any other?
The fact remains, they lack the brains
Or find it too much bother.

Bos

To Build New Power Plant at Montreal

As the result of an agreement between the city of Montreal and the Bank River Power Co. whereby the power company will provide the necessary protection for sewer outlets on the Riviere des Prairies as well as the streets abutting on the river, the power company will now be able to proceed with the construction of a dam below Cedar Island, at which is planned to develop 50,000 hp. An order-in-council was passed by the legislature during its last session authorizing the company to undertake this work as soon as it had reached an agreement with the city of Montreal and had satisfied the Provincial Board of Health that the diversion of the stream would have no injurious effects on public health.

The construction work will include numerous dikes and a dam 1,300 ft. long containing ten 40-ft. sluices for use at times of flood. A 300-ft. channel will be provided on the Montreal island side of the river.

Engineering Societies

Calendar

Annual Meetings

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, Washington, D. C.: Annual Convention, New Orleans, La., Dec. 3-6, 1923.

FEDERATED AMERICAN ENGINEERING SOCIETIES, Washington, D. C.; Annual Meeting, Washington, D. C., Jan. 10-11, 1924.

AMERICAN ROADBUILDERS' ASSOCIATION, New York City; Annual Convention, Chicago, Jan. 14-18, 1924.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Annual Meeting, New York, Jan. 16-18, 1924.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, Washington, D. C.; Annual Meeting, Chicago, Ill., Jan. 21-24, 1924.

AMERICAN CONCRETE INSTITUTE, Detroit, Mich. Annual Meeting (20th anniversary), Chicago, Ill., Feb. 25-28, 1924.

The Engineers' Club of Philadelphia, on Nov. 20 tendered a dinner to Charles M. Schwab, recently elected an honorary member of the club. The speakers were Dr. Robert H. Fernald, Alba B. Johnson, J. Hampton Moore, Mayor of Philadelphia, Admiral A. H. Scales, Julian Kennedy, and Mr. Schwab. The dinner was made the occasion for presenting Mr. Schwab with the certificate of honorary membership in the club. The other living honorary members are Thomas A. Edison, General George W. Goethals, Edgar F. Smith, Herbert Hoover, and Lewis H. Haupt.

The San Francisco Section, Am. Soc. C. E. held a special meeting on Nov. 14 for Secretary Dunlap, who spent one day in San Francisco in the course of his tour visiting western sections. Mr. Dunlap spoke vigorously and enthusiastically about the formation of technical divisions of the society, closer relations with new chapters and local sections, the quarterly meetings and special committees on such subjects as engineering education, and finally the duties of the individual engineer as a citizen. Representatives of the student chapters at Leland Stanford, Jr. University and the University of California asked for the aid of the society and the local section in giving undergraduates a practical view of engineering activities in general. C. D. Marx and C. E. Grunsky supplemented Mr. Dunlap's remarks, referring to past and future activities and endeavors of the society.

Personal Notes

W. Z. BETTS, maintenance bridge engineer for the North Carolina State Highway Commission, has been appointed purchasing agent of the commission to succeed H. V. Joslin.

J. R. WENDT, district maintenance superintendent for maintenance district 8 for the State Highway Commission of Louisiana, has been transferred to Ruston, La., as maintenance superintendent for districts 8 and 9, relieving Fred D. King of district 9, resigned.

C. C. HEZMALHALCH has been appointed deputy state engineer for Colorado, succeeding R. G. Hosea who resigned to enter the automobile business at Fort Morgan. Mr. Hezmalhalch has been a member of the state engineer's staff since 1911.

C. B. ZORN, who has been with the Iowa State Highway Commission for several years, has been appointed county engineer for Monona County at Onawa, Iowa.

GEORGE J. CALDER, consulting engineer, has opened an office at 1010 Eighth Street, Sacramento, Calif., with M. W. SAHLBERG, designing engineer, in charge.

T. C. CARHART and JOHN G. STUPP, sales manager and chief engineer of the St. Louis Structural Steel Co., have resigned and entered the structural engineering business as Carhart & Stupp, with offices in the International Life Bldg., St. Louis, Mo., to engage in the design of buildings and structures for industrial plants.

THOMAS SHANKS of Ottawa, Ont., has been appointed assistant director-general of surveys, a new position in the Department of the Interior of Canada.

R. HOME SMITH, chairman of the Toronto, Ontario, Harbor Commission, has resigned.

VAN CAMP, recently assistant engineer for Tarrant County at Ft. Worth, Texas, has been appointed resident engineer in charge of construction of roads in the National Forest at Mena, Ark., under the U. S. Bureau of Public Roads.

T. H. WEBB, assistant state highway engineer for Texas, has been appointed county engineer of Callahan County in charge of a $500,000 highway improvement program at Baird, Texas.

J. B. RIEMAN has resigned as county engineer of Red River County, Texas, and has been appointed county engineer of Hopkins County.

F. E. DELVIN, consulting engineer, Wichita, Kans., has opened a branch office at Dalhart, Texas, with James Rady as local manager.

A. W. CAMPBELL, chief commissioner of highways of Canada, has gone to England to attend the Public Works, Roads and Transport Congress and exhibition to be held in London this month.

A. P. DAVIS, former director of the U. S. Reclamation Service, has been retained by the City of Los Angeles as consulting engineer in connection with studies of water and power developments which the city has under consideration.

H. V. JOSLIN, purchasing agent of the North Carolina State Highway Commission, has resigned to accept a position as engineer in charge of construction with the Carolina Power & Light Co., Raleigh, N. C.

ERNEST S. MALTICE, formerly managing director of the Phœnix Bridge and Iron Works, Ltd., Montreal, has been appointed chief engineer of Canadian Vickers, Ltd., which recently took over the Phœnix company.

J. L. SIMPSON, British architect and builder, is touring the United States and Canada studying industrial building methods. During his New York visit he was the guest of the John W. Ferguson Co.

GEORGE MCNUTT, construction engineer, North Carolina State Highway Commission, has accepted a position as superintendent of highway construction in North Carolina for the Public Service Corp., of Newark, N. J.

W. R. JOHNSTON, JR., of Maplewood, N. J., has been made terminal engineer of the Lehigh Valley, R.R. He was previously assistant engineer on the Delaware, Lackawanna & Western R.R.

E. PAUL FORD, city engineer of East San Diego, Calif., has resigned, the consolidation of East San Diego with the city of San Diego having been ratified by election on Oct. 23. Mr. Ford will locate in the East.

DENHAM, VAN KEUREN & DENHAM is the new firm name of the consolidation of E. B. Van Keuren & Co., engineers and architects, and William L. Denham and George E. Denham, all of Birmingham, Ala., for the practice of architecture and engineering, with offices in the Herald Bldg., Birmingham.

A. G. MOTT, who has been an assistant engineer in the transportation division of the California State Railroad Commission, has been appointed transportation engineer, succeeding H. G. Weeks, resigned. Mr. Mott is a graduate of Stanford University and for eleven years was employed in various capacities by the Southern Pacific Railway Co.

H. G. WEEKS, transportation engineer of the California State Railroad Commission, has resigned to become assistant to the general manager of the Los Angeles Railway Corp. Mr. Weeks, who has been with the commission since 1913, has dealt with appraisals and rate proceedings, notably

the Los Angeles union terminal and grade crossing elimination cases.

HENRY H. QUIMBY, chief engineer of the department of transit, Philadelphia, Pa., in charge of the planning, construction and equipment of the new municipal high-speed lines, has resigned to engage in private practice.

H. C. FOSTER, formerly associated with the California State Highway Commission, has become affiliated with the Industrial Testing Laboratory of Los Angeles as engineer in charge of road construction.

ANDREW J. O'REILLY, consulting engineer, St. Louis, Mo., has been reappointed a member of the Missouri Public Service Commission. Mr. O'Reilly's new term will expire in 1929; he was originally appointed to fill out the unexpired term of Edward Flad, who resigned from the board about two years ago.

RAYMOND JONES, of the firm of G. W. Jones & Sons, Huntsville, Ala., has been appointed highway engineer for Limestone County, Alabama.

A. C. LINDLEY, engineer of construction work of the Missouri State Highway Commission, has resigned to engage in the road contracting business with LEWIS RICH of Kansas City, Mo.

GEORGE W. DUNCAN, JR., formerly with Leland & Haley, consulting engineers of San Francisco, Calif., has become associated with Albert A. Coddington, consulting mechanical engineer, and they will operate under the firm name of Coddington & Duncan, with offices in the Phelan Bldg., San Francisco.

Obituary

CHARLES A. BIGGER, assistant director of the geodetic survey of Canada since 1905, died suddenly of heart disease at Ottawa Nov. 9 in his 71st year. He was born near Paris, Ont., and for many years practiced as an engineer in Ontario and the West. In 1901 he entered government service and conducted surveys of the international boundary.

LYMAN P. HAPGOOD, former superintendent and since 1922 consulting engineer of the Jamestown, N. Y., water and lighting plants, died Nov. 14 after a long illness. He was 47 years old. Mr. Hapgood was a graduate of the Massachusetts Institute of Technology, class of 1899.

THEODORE C. LINK, architect who designed the St. Louis Union Station, the Washington University medical buildings and several of the buildings at the Louisiana Exposition in St. Louis in 1904, died of pneumonia at Baton Rouge, La., Nov. 12 at the age of 73 years. Mr. Link was supervising the erection of a group of buildings for the new Louisiana University and Greater Agricultural College at Baton Rouge, the projects aggregating $3,000,000. He maintained an office in the Chemical Building, St. Louis. He was born in Germany and educated at Heidelberg, London and Paris.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Is Time for Preparing Bids Too Short?

In the Nov. 8 issue of "Engineering News-Record," p. 783 a manufacturer of waterworks equipment deplored the insufficiency of time usually allowed for preparing estimates or bids on proposed work. Manufacturers of other products used in the construction field expressed their views in the Nov. 22 issue, p. 866. Additional replies follow.—EDITOR.

Cranes

BY A. H. MCDOUGALL
Whiting Corp., Harvey, Ill.

WE have experienced the same difficulty when bidding on government and municipal work.

With reference to government bids, we have often received notice that bids would be received at a certain time and we would not have time to write to get specifications back and submit a bid. Sometimes there is not time even to receive the specification.

I feel that a great deal of this is due to the time that is taken up in elaborately preparing specifications and drawings for the work. Then the one for whom the work is to be completed gets in a terrible rush over the delay and therefore shortens the time for receiving the bids.

Water Meters

BY J. B. KIRKPATRICK
Neptune Meter Co., New York.

I BEG to advise that the Neptune Meter Co. is not complaining about the shortness of time available for the submission of estimates or bids on proposed contracts.

Cast Iron Pipe

BY D. B. STOKES
U. S. Cast Iron Pipe & Foundry Co., Philadelphia

WE have not experienced any trouble along the lines of insufficient time for preparation of estimates or contract bids. Probably the fact that a larger portion of our product for municipal use is made in accordance with the American Water Works Association specifications explains this. Were the material of more intricate design we might require more time to properly prepare a bid.

Automobile Production

Automobile production during the month of October totaled 360,924 cars and trucks, according to reports made to the National Automobile Chamber of Commerce. The total production of cars and trucks for the first ten months of 1923 has been 3,388,785 as compared with 2,119,111 for the same month of last year.

Gen. Tripp Honored by Japan

The government of Japan has conferred the second degree order of the Sacred Treasurer upon Gen. Guy E. Tripp, chairman of the board of the Westinghouse Electric & Manufacturing Co. This is the highest decoration that can be awarded a civilian foreigner by the Japanese government.

GUY E. TRIPP

General Tripp is in Japan at the present time in connection with reconstruction work following the recent severe earthquake, and his decoration was in recognition of his activities in assisting the Japanese officials in rebuilding the devastated area. During the World War he served as assistant to the Chief of Ordnance with rank of brigadier general. For meritorious service in this position the Distinguished Service Medal was conferred upon him by the President of the United States.

Brick Makers Will Produce Large Stocks for Next Season's Work

Not since the war, according to the monthly statement issued Nov. 1 by the Common Brick Manufacturers' Association, have the brick men gone into the closing months of the year with such determination to pile up stock as is manifested in current reports of 132 manufacturers doing business in 43 states. The situation on the Hudson River, which provides the brick supply for Greater New York operations, is indicative of what is going on in all the large brick-producing centers. By the time Hudson River navigation opens next spring it is anticipated that the plants along the river will have 600,000,000 brick ready for shipment to their markets. This is 50 per cent greater than the winter stock in any recent year.

Plants are running at full time and will continue until freezing weather stops operations. Those plants equipped for winter running will continue throughout the interim before the coming season. These preparations are going on with the New York manufacturers in spite of the fact that quantities of foreign brick still lie on barges at the docks and many more millions of brick are on their way from Holland and Germany.

Reeves Heads Trade Executives

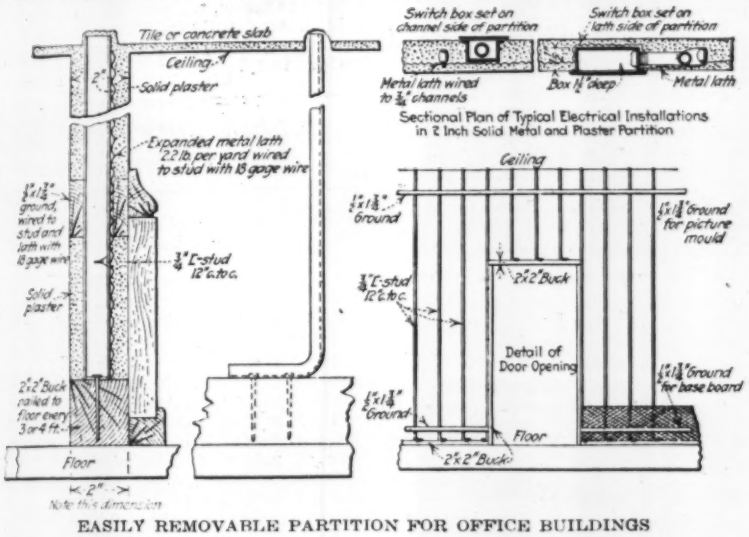
At its convention in Chicago last month the American Association of Trade Executives elected as its president Alfred Reeves, general manager of the National Automobile Chamber of Commerce. This organization consists of the managers or other executive officers of 158 trade associations.

A Space-Saving Office Partition

To save space in office buildings a new type of 2-in. solid plaster metal-lath partition has been designed by the Swetland Co., Cleveland, in co-operation with the Cleveland Association of Building Owners and Managers and the Associated Metal Lath Manufacturers. Economy of erection is one of the advantages claimed for this partition.

The details of its construction are shown in the accompanying drawing. Attention is directed to the fact that the wood grounds may be nailed together by long nails, bent over and clinched. The drawing shows the grounds wired to each side of the stud.

If picture molding or cornice is erected at, instead of below, the ceiling


Tile or concrete slab
Ceiling
2"
Solid plaster
Expanded metal lath 2.2 lb. per yard wired to stud with 18 gage wire
Solid plaster
2"x2" Buck nailed to floor every 3 or 4 ft.
Floor
2"
Note this dimension
Switch box set on channel side of partition
Switch box set on lath side of partition
Metal lath wired to ¾" channels
Box ½" deep
Metal lath
Sectional Plan of Typical Electrical Installations in 2 Inch Solid Metal and Plaster Partition
Ceiling
Ground
Ground for picture mould
¾" L-stud 12" c. to c.
2"x2" Buck
Detail of Door Opening
Ground for base board
Ground
Floor
2"x2" Buck

EASILY REMOVABLE PARTITION FOR OFFICE BUILDINGS

line it may be advisable to have a 2x2-in. buck at the ceiling. The channel studs may be attached to the floor buck by boring holes ⅜ in. in diameter in the buck and inserting the stud in these holes. This method saves bending the stud. It is essential to have a steel channel stud on each side of the door buck.

Trailer Association Would Admit Camping Equipment Makers

The membership committee of the Trailer Manufacturers Association, New York, announces that overtures have been made to the manufacturers of camping trailers in regard to joining the association. The association at present is composed exclusively of makers of commercial trailers. While the camp trailer is a very different vehicle and appeals to a different class of purchaser, the truck trailer men believe that they have enough in common with the camp trailer makers to furnish ground for co-operative work.

Construction Equipment Exported

Exports of construction equipment from the United States during September are shown in figures just issued by the Department of Commerce. During the month there were shipped 53 concrete mixers valued at $38,999, eleven of these units going to Japan; 3 power shovels, at $42,195; 185 conveyors, at $30,298; and 373 hoists and derricks at $87,296.

Claim Infringement of Pneumatic Concrete Placing Patent

Suit has been brought in the United States Court in New York for the infringement of the MacMichael patent No. 1,127,660 of Feb. 9, 1915, by the Concrete Mixing & Conveying Co. against the Ulen Contracting Co. on account of the use by the defendant of pneumatic concrete conveying and placing machines in the Shandaken tunnel of New York City's Catskill aqueduct. The development of this system by MacMichael dates back to 1907, when the application for the patent under which suit is brought was filed.

The apparatus involved in the infringement is known as the Webb-Cox placer, and operates in the tunnel to shoot the concrete dumped therein along a conduit by the action of compressed air and place it around the forms for the tunnel lining. Suits against other infringers are expected to follow.

Material-Handling Equipment To Be Shown at Power Show

Material-handling equipment will be a new feature of the second National Exposition of Power and Mechanical Engineering to be held at the Grand Central Palace, New York, Dec. 3-8. The equipment to be exhibited will include conveyors of all kinds, locomotives, industrial trucks, elevators, hoists and large scales. One exhibitor is to install a working model of a complete system of steel-belt conveyors for handling sticky materials, sharp-edge materials or materials at high temperature. Another manufacturer will show a working model of complete coal-handling equipment in a minature power house. The model will show a skip-hoist, bunker, coal weigh larry and cable drag scraper. A program of motion pictures showing the application of equipment will be displayed.

The Power Exhibition, held annually, features the development of apparatus for the economical combustion of fuel and the production and utilization of power. The managers of the exposition are Fred W. Payne and Charles F. Roth with offices in the Grand Central Palace.

Pan-Americans to Inspect U. S. Roads and Transport

Trip for Forty Delegates Arranged by Automotive, Road Machinery, Financial and Government Interests

FORTY delegates will be brought to this country from Pan-American countries to make an intensive study of highways and highway transport under the terms of a plan approved by government, automotive, road machinery, road material and banking representatives at a meeting held in New York, Nov. 22. The proposal as outlined by J. Walter Drake, Assistant Secretary of Commerce; T. H. MacDonald, chief, U. S. Bureau of Public Roads, and Dr. G. Sherwell, secretary-general of the Inter-American High Commission, provides that the men to be invited will be named here, and all of their expenses will be paid by private subscription.

The immediate purpose is to give the delegates a sufficient understanding of developed highway transport to enable them to participate actively in the Pan-American Highway Congress proposed at the last meeting of the Pan-American Union and which will be held as a separate project next year. The ultimate objective is the promotion of closer relations between the United States and the other countries of the Americas.

Roy D. Chapin, Hudson-Essex Co.; W. A. Beatty, Austin Manufacturing Co., and Fred I. Kent, Bankers Trust Co., were named as an executive committee. Details in this country will be handled by the Highway Education Board. S. T. Henry, Allied Machinery Co. of America, will manage the project.

The motor industry was represented at the meeting by Roy D. Chapin, vice-president of the National Automobile Chamber of Commerce; Alfred Swayne (General Motors); A. J. Brosseau (Mack); and Alfred Reeves, George Bauer and Pyke Johnson of the National Automobile Chamber of Commerce.

Cement Industry Worked at 20% Below Capacity in 1921

Cement manufacture during 1921 was at a rate more than 20 per cent less than the capacity of the industry. Had conditions been such as to make maximum output possible, cement to the value of $259,015,207 would have been manufactured during that year. Instead the value of the output of the 125 cement plants of the country was $203,626,929, or 78.6 per cent of the possible output.

These figures have just been made public by the Bureau of the Census. They were compiled as a result of recommendations by the Committee on Census Schedules, created at a conference of trade associations which met in Washington in 1921 at the instance of the National Association of Manufacturers. Nathan B. Williams was chairman of the committee.

Paving materials manufacture was at a rate slightly greater than half the capacity of the industry to produce. Had conditions in that industry been such as to make possible maximum output paving materials to the value of $104,724,458 would have been produced. As it was, the value of products aggre-

gated $61,128,969, or 58.4 per cent of the possible output.

The percentage of possible output among all of the industries of the country was 56.8. This covers 194,194 establishments, with a combined value of products of $42,318,241,453. Had these plants worked at maximum capacity, they would have produced, $74,123,930,736.

Business Notes

NATIONAL STEEL FABRIC CO., Pittsburgh, established on Nov. 1 a dealer sales department in charge of W. H. Shaffer, Jr., who for seventeen years had filled a similar position with the Universal Portland Cement Co. The function of the new department is to promote sales of dealers and to expedite deliveries of materials.

NATIONAL LIME ASSOCIATION, Washington, D. C., announces the appointment of Burton A. Ford as secretary and general manager. For the past three months Mr. Ford has been acting secretary of the association. He is a graduate of the University of Maryland, and until the summer of 1922 was with the Virginia-Carolina Chemical Co. in the capacity of division manager, and was also secretary-treasurer of the Bryant Fertilizer Co. In the summer of 1922 he became assistant to W. R. Phillips, who was then general manager of the National Lime Association.

HARRY MEACHEM, formerly of Dean Bros., Indianapolis, has been appointed vice-president and general manager of the Rider-Ericsson Engine Co., New York.

UNITED STATES CAST IRON PIPE & FOUNDRY CO., Burlington, N. J., announces the appointment of Thomas P. Anthony as chief engineer, with headquarters at Burlington. P. T. Laws has been chosen as the company's Southern district manager, with headquarters at 1002 American Trust & Savings Bank Building, Birmingham, Ala.

CHAIN BELT CO., Milwaukee, manufacturer of Rex chain, concrete mixers and conveying equipment, formerly represented on the Pacific Coast by Meese & Gottfried Co., San Francisco, has established direct factory branches and warehouses in Portland and Seattle. Arrangements have also been made with the Washington Machinery Depot, Tacoma, to carry stocks of chain and transmission machinery. Other stocks will be placed in important centers throughout the Pacific Northwest for the prompt handling of local requirements. The Northwest territory, with headquarters at Portland, will be in charge of Allen C. Sullivan, formerly connected with the Allis-Chalmers Co., Milwaukee, and more recently with Smith & Watson Iron Works of Portland. Don B. Catton, formerly with Meese & Gottfried Co. and later engaged in the machinery supply business on his own account will be the special sales representative for the Portland office. The Seattle and British Columbia territory will be handled by William F. Nichols who for the past 11 years has been with the Meese & Gottfried Co.

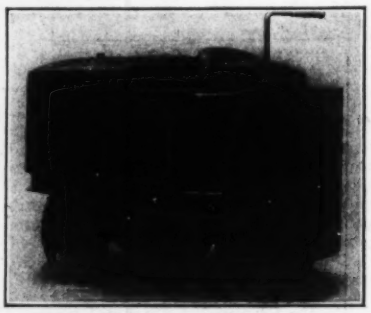
Equipment and Materials

Cork Foundations to Reduce Vibration of Machinery

To minimize the vibration of heavy machinery the Korfund Co., New York, has placed upon the market a cork foundation plate of German origin, made of solid blocks of natural cork bound together into rectangular slabs by iron straps and impregnated by a method which is claimed to prevent decay and at the same time preserve the maximum elasticity of the cork. These insulation plates are in the form of rectangles 4 in. thick and 10 x 12 ft. in plan. This type of insulating foundation, the manufacturer claims, not only increases the life of the machine which it supports but also prevents damage to buildings in which machinery is housed. The cork plates may be obtained to fit any size of machinery and any shape of foundation. The company also manufactures a cork insulating plate to be placed between the tie and the rail of a railway track.

Internal-Gear Industrial Tractor

A new storage-battery tractor brought out by the Mercury Manufacturing Co., Chicago, for industrial service in shops, freighthouses and manufacturing plants, differs from the company's previous designs in having an internal gear in-



stead of a worm-gear drive. An increased work efficiency of 25 to 35 per cent is claimed for this design, increased power being accompanied by a decrease in power consumption. A pinion driven by the motor through a flexible coupling drives a bevel gear in the axle housing and this gear in turn drives the axle pinions for the two rear wheels. Each pinion transmits the power through three idler gears to an internal or ring gear on the inside of the rim of the 20-in. driving wheel. With a gear ratio of 18 to 1 the drawbar pull is 475 lb. normal and 1,800 lb. maximum, while with a ratio of 24 to 1 the figures are 600 lb. and 2,100 lb. respectively.

The power unit, including a high-speed motor, is self-contained and can be detached from the machine by removing two bolts. Heat-treated chrome manganese steel is used for all gears. The steel frame carrying the battery box and control apparatus is carried by semi-elliptic springs and four rubber-tired wheels, but the two 15-in. front wheels are mounted on a short axle to give as short a turning radius as a three-wheel arrangement. This radius is 5 ft. The service brake has shoes bearing on a drum on the motor armature. When the driver dismounts an emergency brake is set automatically by a spring under the seat, the same spring also shutting off the current. A rear coupler is carried by a cast-steel fork attached to the axle housing, so that the pulling strain is taken directly by the axle and not by the frame and springs. At the front end is a combined fender and bumper to protect the driver and to permit of pushing trailers when necessary.

In overall dimensions the machine is 5 ft. 8 in. long, 3 ft. 3 in. wide and 4 ft. high. Its weight is 1,850 lb. without battery and from 2,750 to 3,350 lb. in working order, according to the kind of battery and number of cells. The speed capacity, without load, is 660 and 572 ft. per minute for 18 to 1 and 24 to 1 gear reduction, or 7½ and 6½ m.p.h. respectively.

Publications from the Construction Industry

Metal Lath Data—TRUSCON STEEL CO., Detroit has included in its 48-p. illustrated "Metal Lath Data Book" a mass of information well arranged and clearly expressed, on approved methods and specifications for the use of metal lath in building construction of all types. The information should be particularly valuable to engineers, architects and contractors. The text represents a year's study of the practical uses of metal lath. There are a number of pages of detailed drawings of partitions, walls, floors, roofs, and attached and suspended ceilings. Suggestions also are offered for interior plastering and exterior stucco work. Useful data on loads and properties of Hy-Rib are contained in the form of tables. For all uses of metal lath described and illustrated detailed specifications are given.

Power Shovels—MARION STEAM SHOVEL CO., Marion, Ohio, features its ¾-yd. revolving electric and gasoline-electric shovels in a newly issued 16-p. illustrated bulletin. Data are given showing comparative cost of steam, electric, and gasoline-electric operation, and the various mechanical features of the machine are illustrated and described in detail. A feature of the shovel is the use of separate motors for the three main operations of crowding, hoisting and swinging.

Hydraulic Dredging Machinery—MORRIS MACHINE WORKS, Baldwinsville, N. Y., features its sand and dredging pumps and hydraulic dredging machinery in a 44-p. illustrated booklet just published. The text includes a discussion of sizes and capacities of hydraulic dredges, the use of hydraulic dredges for the production of sand and gravel and hydraulic mining operations. Detailed illustrated descriptions are given of the company's standard dredge pumps, including models belt-driven, direct-connected to steam engines and motor operated. Part of the text is devoted to auxiliary equipment, such as cutters, agitators, hoists, sheaves and spuds.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for, in Construction News, pp. 291 to 303, are the following:

High School, Boston, Mass., Dept. Pub. Wks., $1,200,000.

Hotel, Birmingham, Ala., T. H. Molton, $1,500,000.

Dam, Los Angeles, Calif., Los Angeles Co., $20,000,000.

Large Contracts Let During Week

Among the weeks announcements of contracts awarded in Construction News, pp. 291 to 303, are the following:

Power Plant, Davenport, Ia., United Light and Railways Co., Grand Rapids, Mich., $10,000,000.

Apartment Hotel, Dallas, Tex., to Gilsonite Constr. Co., $1,800,000.

Hotel, San Diego, Calif., to Vukicevick & Bagge, San Francisco, $1,000,000.

Apartment, New York, N. Y., $1,000,000.

Hotel, Louisville, Ky., to Rommel Bros., $2,300,000.

Recent Unit Bids Throughout the Country

The accompanying table gives representative bid prices of various materials and operations, applying on a number of the more important contracts awarded during the last month.

A workable acquaintance with construction cost in outlying districts, may be had by studying the unit bids published weekly in the Construction News section of *Engineering News-Record.*

Common Brick Imports Increase

Receipts For Last Three Months Gain Heavily Over Preceding Quarter —Domestic Output Heavier

Nearly 19,000,000 common brick were imported into this country, through the Port of New York, during the third quarter of the current year as against 10,379 for the preceding quarter. According to the Bureau of Foreign and Domestic Commerce the actual total was 18,953,000 (valued at $155,502), 18,365,000 of which came from Holland.

These brick, with few exceptions, conform to the American standard size, i.e., 8 x 3¾ x 2¼ in., and have not materially affected the domestic common brick quotation, neither have they pene-

UNIT-BID PRICES ON IMPORTANT MATERIALS AND OPERATIONS IN RECENT CONTRACTS AWARDED

Where Located	E.N.R. Issue	Nature and Extent of Job	Unit Bid Price
Calif., Eureka	Oct. 4	12,500 ft. 2 in. standard black pipe, per ft.	$0.1688
Calif., Los Angeles	Oct. 4	700,000 cu.yd. dredging	$94,080.00
Calif., Yuba City	Oct. 11	42,000 cu.yd. suction dredging, per cu.yd.	.50
Calif., Los Angeles	Oct. 11	1 mi. Conc. pavement, per sq.ft.	.23
		1 mi. Curb, per lin.ft.	.70
		1 mi. Sidewalk, per sq.ft.	.25
Calif., Los Angeles	Oct. 18	40,000 bbl. cement, sacks 15c. extra, 5c. per bbl., f.o.b. cars Crestmore.	2.55
		40,000 bbl. cement, sacks 15c. extra, 5c. per bbl.	3.112
		40,000 bbl. cement, sacks 15c. extra, 5c. per bbl., f.o.b. cars Colton.	3.115
		6,000 cu.yd. excav., per cu.yd.	.65
Calif., Ventura	Nov. 15	21,765 ft. rolling, per ft.	.20
		348,224 sq.ft. 5 in. asphaltic conc., per sq.ft	.178
		180,000 sq.ft. 6 in. bituminous pave., per sq.ft.	.2275
Calif., Los Angeles	Nov. 15	9,512 ft. curb, per ft.	.65
		44,710 sq.ft. walk, per sq.ft.	.20
		10,800 sq.ft. gutter, per sq.ft.	.30
		7,121 sq.yd. pave., per sq.yd.	2.84
Ia., Oskaloosa	Oct. 4	5,492 lin.ft. conc. curb and gutter, per lin.ft.	.84
		Grading, per cu.yd.	.70
Ia., Cherokee	Oct. 11	98,503 cu.yd. excav. (road grading), per cu.yd.	.27
Ill., Belleville	Oct. 11	12,000 ft. (14 ft. road) rein.-conc. pave.	108,391.00
Ky., Frankfort	Oct. 18	77,009 cu.yd. earth excav., per cu.yd.	.38
		58,818 cu.yd. solid rock excav., per cu.yd.	.98
		43,262 cu.yd. loose rock, excav., per cu.yd.	.80
		1,958 ft. 18 in. conc. pipe, per ft.	2.75
		1,268 ft. 24 in. conc. pipe, per ft.	4.00
Mass., Medford	Oct. 18	20,500 sq.yd. bituminous macadam pave.	48,000.00
Mass., Boston	Oct. 25	46,950 sq.yd. 4 in. bituminous conc., per sq.yd.	1.55
		11,320 cu.yd. excav., per cu.yd.	1.50
Miss., Canton	Oct. 4	Excavation, per cu.yd.	.60
		Curb and gutters, per lin.ft.	.90
Mich., Lansing	Oct. 11	17,711 cu.yd. excav., per cu.yd.	.60
		43,352 sq.yd. 7 in. rein.-conc. pave., per sq.yd.	1.25
Mich., Lansing	Oct. 18	9,338 cu.yd. earth excav., per cu.yd.	.50
Minn., St. Paul	Oct. 11	18,700 cu.yd. gravel surfacing	21,790.00
Mo., Sedalia	Oct. 11	11,200 sq.yd. grading and conc. pave., per sq.yd.	2.35
Miss., Albany	Nov. 15	17,625 cu.yd. common excav., per cu.yd.	.35
		11,882 cu.yd. borrow excav., per cu.yd.	.36
		15,998 cu.yd. gravel 1 mi. haul, per cu.yd.	.88
N. J., Bordentown	Oct. 4	1,800 ft. 6 in. c.i. pipe	9,600.00
N. Y., Brooklyn	Oct. 11	300,000 gal. asphaltic cement	15,600.00
		6,000 cu.yd. binder stone	13,860.00
		50,000 asphalt paving blocks	4,780.00
		50,000 grade 1 granite paving blocks	6,900.00
		50,000 wood paving blocks	2,950.00
N. Y., Brooklyn	Oct. 18	1,200 lin.ft. 12 in. vit. sewer pipe, per ft.	3.00
		260 lin.ft. 15 in. vit. sewer pipe, per ft.	4.00
		350 lin.ft. 18 in. vit. sewer pipe, per ft.	5.00
		300 lin.ft. 24 in. vit. sewer pipe, per ft.	7.00
		50 lin.ft. 6 in. water sewer pipe, per ft.	1.50
		200 lin.ft. 8 in. water sewer pipe, per ft.	2.50
		4,960 lin.ft. stone curb, per lin.ft.	1.35
		3,400 sq.yd. brick gutter, per sq.yd.	2.35
O., Akron	Oct. 11	53,600 sq.ft. sidewalk, per sq.ft.	.22
		26,000 sq.yd. earth excav., per sq.yd.	.60
		16,800 sq.yd. Texaco asphalt, per sq.yd.	1.50
		8,360 sq.yd. vitr. brick, per sq.yd.	2.30
O., Columbus	Nov. 15	3,000 ft. 8 in. c.i. pipe	41,785.00
Pa., Waynesburg	Oct. 4	2 mi. conc. road.	108,729.00
Pa., Philadelphia	Nov. 15	1,000 ton crushed stone, per ton	2.87
S. C., Dillon	Oct. 4	6.9 mi. sand clay road	36,362.00
S. D., Sioux Falls	Oct. 11	1 mi. conc. pave.	35,000.00
Texas, Dallas	Oct. 18	4 in. class B, c.i. pipe, per ton	65.00
		12 in. class B, c.i. pipe, per ton	61.00
Wash., Olympia	Oct. 11	3,520 sq.yd. crushed rock surfacing, per sq.yd.	2.00
		3,800 cu.yd. excav., per cu.yd.	.30
		12,260 cu.yd. excav. loose rock, per cu.yd.	.55
		15,180 cu.yd. excav. solid rock, per cu.yd.	1.50

trated very far inland, most shipments having been consumed in the New York district.

Common brick in the New York market are quoted at $19 per M wholesale, alongside dock, as against $19@20 one month ago. This decline, however, is seasonal and does not reflect the influence of importations.

Brick importations through the Port of New York, during the last quarter, are shown in the following table:

	Number	Value
July:		
Holland	9,443,000	$74,377
August:		
Canada	100,000	1,380
Holland	3,373,000	26,989
September:		
Germany	63,000	411
Holland	5,549,000	48,420
Canada	425,000	3,925
Total	18,953,000	$155,502

Reserve stocks of burned and unburned brick, particularly in the New York district, are 50 per cent greater than winter stocks in any recent year. According to the Common Brick Manufacturers' Association of America, brickyards are running at full time and will continue until freezing weather stops operations. Those plants equipped for winter running will continue operations until spring. These preparations are going on with the New York manufacturers despite the quantities of foreign brick on barges at the docks.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of Nov. 1; the next, on Dec. 6.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb.	$3.64	$4.00	$4.20	$3.40	$3.55	$4.20	$3.60	$4.10	$4.25
Structural rivets, 100 lb.	4.40	4.75	4.90	3.75	4.25	5.30	5.00	4.25	6.00
Reinforcing bars, ¾ in. up, 100 lb.	3.54	3.50	3.38	3.20	3.45	3.85	3.65	4.10	4.00
Steel pipe, black, 2½ to 6 in. lap, discount	44%	40%	43%	47%	53–5%	36%	33.2@42.2%	35%	47.43
Cast-iron pipe, 6 in. and over, ton	62.10@63.60	54.75	61.00	57.20@60.20	60.50	69.00	—59.00	62.00	60.00
Concreting Material:									
Cement without bags, bbl.	2.55@2.65	2.60	2.05	2.10	2.42	2.84	2.61	2.90	2.25
Gravel, ¾ in., cu.yd.	1.75	1.85	2.38	2.00	1.85	1.90	2.15	1.25	1.50
Sand, cu.yd.	1.25	1.24	2.00	2.00	1.25	1.00	1.50	1.25	1.25
Crushed stone, ¾ in., cu.yd.	1.75	2.00	2.83	2.00	2.00	3.50	2.15	3.00	1.90
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	61.00	39.00	54.75	57.50	44.75@45.75	48.00	41.00	29.50	42.00
Lime, finishing, hydrated, ton	18.20	25.00	23.50	20.00	25.50	24.00	22.00	24.00	21.00
Lime common, lump, per bbl.	3.00@3.25	1.60	1.85	1.50	1.50	2.70	2.10	2.80	9.50
Common brick, delivered, 1,000	+22.55	11.00	11.60	11.00	16@18	12.00	15.00	15.00	16.50
Hollow building tile, 4x12x12, per block	Not used	.102	.110	.0724	.075	.065	.....	.11	.115
Hollow partition tile 4x12x12, per block	.1179	.102	.110	.....	.....	.065	.108	.11	.....
Linseed oil, raw, 5 bbl. lots, gal.	.98	.96	1.03	1.14	+.99	1.07	—1.03	1.15	1.38
Common Labor:									
Common labor, union, hour	.75	.35	.....	.....	.....	.50@.55	.55	.62½	.....
Common labor, non-union, hour	....	.30	.30@.50	.82½	.50@.55	.35@.50	.50	.62½	.30

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given: 45-5% means a discount of 45 and 5 per cent. Charge is 15c. per 100 lb. for cutting reinforced steel into 2-ft. lengths or over.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 93½c.; building laborers (pick and shovel men) 75c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.80 for Kelly Island and $1.70 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in iron bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on white pine lumber, free on cars at mill. Sand, stone, gravel and lump lime per ton. Cement, lime and tile are delivered; sand, gravel and stone on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 97.91). Bag charge is 20c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 3-in., $47.43; 6-in., $119.

Changes Since Last Week

Increased activity in pig-iron buying is possibly the most favorable factor in the current business situation. Sales, though not involving large tonnages, constitute a marked contrast with the recent dullness in this important commodity.

Rise in cotton prices and a recovery of the foreign exchange are also noteworthy features of the weeks' developments.

Car loadings for the last twenty-one weeks have passed the million mark. A total of 1,036,067 cars were loaded during the week ended Nov. 10. These freight movements indicate heavy distribution of materials for this time of the year.

The trend of the lumber movement indicates a falling off in production but at the same time a substantial increase in shipments and new business.

Cement prices declined 8c. in Minneapolis and 10c. per bbl. in Chicago, during the month. Similar recessions occurred in eleven other cities in the Middle West.

The Japanese Embassy on Nov. 14, advised the National Lumber Manufacturers' Association, that contracts for 97,150,000 ft. of lumber had already been awarded. Contracts were also let, during the month, by the Japanese Ambassador, in behalf of the Japanese Government, for 20,000 tons of steel sheets, to the U. S. Steel Corporation; 2,000 tons of wire nails to the Youngstown Sheet and Tube Co. and 1,000 tons of wire nails to the Pittsburgh Steel Company.

Common brick advanced $1 per M., wholesale, alongside dock New York, making the present price $19, against $18@$19 per M., one week ago. The advance was evidently due to a general movement on the part of materials buyers, to cover their requirements against a possible Spring shortage.